ACTIVITY-BASED COSTING: A REVIEW WITH GROUNDED THEORY-BASED CASE STUDY

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ABSTRACT

This thesis reviews the Activity-Based Costing (ABC) literature, and analyzes its origins, nature, and development as a precursor to the case study. In addition, a constructive approach to research is used to develop techniques which integrate ABC theory with traditional methods to enhance its application for continuous improvement in practice.

The case study employs a grounded theory research approach based on participant observation to explore the technical and organizational change process as a result of implementing Activity-Based Costing at Calor Gas.

In terms of technical change, the case reveals a number of significant issues impacting upon the practicality of ABC systems which are neglected in the literature. The application of grounded theory resulted in the formulation of several hypotheses which are integrated in the construction of conceptual models, and are pertinent to the future study of implementation issues. The models address three main problems. The first problem focuses on the potential conflict between product costing and Activity-Based Management (ABM) objectives. The second deals with establishing criteria for the formulation of activities. The third is concerned with establishing a suitable set of cost objects. Each problem is presented as it was discovered in the context of the case. Diagrams are used to depict critical factors, and to show relationships between variables in order to find more general solutions.

In terms of organizational change, an "evolutionary" theory about the process of change is developed. It is a process of change whereby the organization learns to adapt to a new environment and conditions. Organizational changes occur in small increments relative to the pace of learning, and the organization grows and matures in order to accommodate the introduction of new knowledge systems. New skills, language, technical concepts and structures are developed. Some of the changes that occurred in the case were planned, some were unplanned, but all were part of the general evolutionary process of an organization adapting to its environment.

"One way of seeing is a way of not seeing."

Cooper, D. 1983. *Accounting, Organizations, and Society (Vol. 8)*

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PREFACE

Studying ABC at Calor Gas has been a rich and fulfilling experience. Researching one of the most prominent management accounting techniques in recent history has given me a new appreciation of the innovative potential of a seemingly stagnate area of study. It has helped me to develop my research skills, using a new research methodology. As a result of this research project, I have been fortunate enough to publish an article in the Journal of Cost Management (Fall 1995), and an article in International Journal of Production Economics (April 1996).

ACKNOWLEDGEMENTS

I would like to thank Professor Falconer Mitchell for his support and guidance and for his unselfish commitment to the completion of this work. I would also like to acknowledge the advice of Sue Llewellyn who provided a unique critical perspective for this thesis. Of course, this research would not have been possible if it were not for the time and effort given from those at Calor Gas, particularly Suzanne Grahame and Jim Kearney. Most of all I would like to thank my loving wife Lee, who believed in me even when I doubted myself.

DECLARATION

I declare that this thesis has been composed by me and all work reported in it is my own.

Chris Salafatinos Edinburgh 1996

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

The field of management accounting and the business environment in general has undergone many changes in the last decade due to the rise in global competition and advances in technology. Increased competition forced management to look more critically at product mix, pricing and product design. Technology gave management new tools for improving performance in the production of goods and services, and in the dissemination of information. Management accounting in general has been criticized for not adapting to these changes and, indeed, branded by some as dysfunctional in the modern business environment (Johnson and Kaplan 1987a). In response to these changes and criticisms, companies have sought to develop new management accounting technologies. One of the most important trends has been the quest to gain more accurate information about the consumption of resources used to produce, sell and deliver products and services to the customer.

Activity-Based Costing (ABC) was introduced during the late 1980's as an alternative approach to traditional cost management. Professional and academic articles proliferated and success stories began to advance the popularity of ABC. At first, it was only the big firms who were able to implement ABC systems (Hewlett-Packard, Ford Motor, Xerox). As affordable computer based software became available and consultancy groups offered ABC implementation services, ABC became more accessible to the average company.

The characterization of ABC has varied from "revolutionary" (Turney 1990) to "nothing more than another allocation system" (Piper and Walley 1990). However it is described, it has clearly caused a significant debate in the management accounting field. Numerous studies have now been conducted attempting to assess the benefits of implementing ABC (Cooper 1990b, Noreen 1991, Innes and Mitchell 1995). Research from an organizational and behavioral perspective has also been undertaken on a case study basis (Bhimani and Pigott 1992a, Friedman and Lyne 1995). However, no studies have been conducted on the basis of participant observation using grounded theory to study the implementation of ABC from its inception to its completion. This is the method and focus of this study.

Grounded theory is a research technique and methodology which offers the researcher a systematic approach to entering the field of study without constructing hypothetical statements or subscribing to previous theoretical models. The researcher has the opportunity to become immersed in the long-term study of organizational phenomenon without losing the necessary scientific rigor for quality research. It is a research technique little used in the accounting domain and so its application here provides an additional attribute of the study.

Participant observation provides a different perspective from traditional scientific inquiry. Conventional scientific research protocol attempts to limit the researcher involvement with the phenomenon under study to protect the results from "researcher bias" and the "Hawthorn effect" (Mayo 1933). As a result, researchers have been encouraged to become passive observers permitted to learn by only "watching", and "asking", but not by "doing". Each form of learning creates its own unique character of knowledge and each possess the potential to contribute to research. To illustrate this point, consider learning how to ride a bicycle. By asking questions about riding a bike, the researcher may learn about basic functions, range of application and about the process of operation. By observing bike riding, the researcher may learn about how the rider tilts when turning or how one obeys specific traffic rules. Finally, by actually riding a bike, the researcher begins the learn and understand the "un-ask-able" and the "un-observable" detail of balance and speed. However, this thesis does not suggest that participant observation is a superior technique of investigating accounting phenomenon, it merely suggests that in spite of the potential risks, learning by "doing" can positively contribute to management accounting research by offering another perspective.

The aim of this research is to use the participant observation perspective and the grounded theory technique to learn about the implementation of ABC and the process of change in management accounting. Unlike previous research, this thesis does not attempt to determine the validity or theoretical soundness of ABC concepts. Nor does it seek to support the use of ABC as a superior system for cost management. The empirical material presented in this thesis is primarily based on the experiences of organizational participants of the ABC implementation process at Calor Gas Scotland. In particular, this thesis seeks to examine the development of technical constructions used to solve implementation hurdles and to understand the organizational change process which takes place during the implementation period.

This thesis is divided into two major parts. Part 1 concentrates on the nature, development and assessment of ABC. First, a historical perspective on activity accounting development is presented followed by an illustration of the calculative structure and implementation issues found in previous research. Next, ABC is compared with conventional cost management constructions followed by a discussion of ABC in broader terms of Activity-Based Management (ABM). Part 1 concludes with an outline of ABC applications and other derivations followed by a discussion of the theoretical and practical limitations of ABC.

In Part 2, the case study of Calor Gas is presented. It begins with a description of the research method and methodology followed by a brief introduction to the case study. The case study results offer both technical and organizational perspectives of the change process. Technical constructions focus on the implementation problems and the development of solutions and conceptual models. This is followed by the introduction of an "evolutionary model of change" developed from the grounded theory technique to depict the organizational change process associated with implementing ABC. Finally, several hypothesis are developed from the research results which could be used for understanding other organizations who are faced with the introduction of new knowledge systems.

PART ONE:

NATURE, DEVELOPMENT AND ASSESSMENT

The aim of Part 1 of this thesis is to review previous literature on Activity-Based Costing (ABC) and to gain an understanding of its origins, construction and application. Part 1 consists of nine chapters.

Chapter two introduces ABC and considers its historical development as a prelude to an examination of the logic and theory behind ABC. It also contrasts ABC with traditional costing systems.

In chapter three the basic calculative structure is presented. The structure is illustrated by using a step-by-step example of how a basic model is constructed.

Chapter four moves on to consider both the technical and organizational issues relevant to the implementation process. It suggests that multiple progression paths exist and outlines planning considerations relevant to adoption of the technique.

Chapter five develops the preceding material to construct a model for reconciling traditional supply-type systems with ABC demand-type systems.

Chapter six focuses on the widening applicability of activity information in the form of Activity-Based Management (ABM), addressing general management problems such as performance measurement, strategic analysis, productivity, and quality improvement.

Chapter seven discusses technical issues which can be derived from an analysis of the purposes of ABC application and is made up of two sections. Section one considers the qualitative dimension of attributes in a contribution margin decision making scenario. Section two suggests a connection between ABC and the Theory of Constraints (TOC) developed through use of activity maps.

Chapter eight moves on to discuss the organizational consequences from the implementation of ABC.

Chapter nine is a critique of ABC and outlines its theoretical and practical limitations.

Finally, Chapter ten is a summary of the relevant literature presented in Part 1 as a precursor to the case study that follows in Part 2.

CHAPTER TWO

BASICS ISSUES AND ORIGINS

2.1 INTRODUCTION

Activity-based costing has become an important aspect of modern managerial accounting (Kaplan 1988, Cooper 1988a, Johnson 1988, 1990c, Innes and Mitchell 1990b, Turney 1990). It has raised serious questions about traditional cost concepts, exposed the weaknesses of conventional cost allocation methods, and expanded the role of accounting information with respect to process improvement and organizational development.

This chapter begins with an evolutionary picture of the origins of ABC. An historical perspective on early concepts is integrated into more current applications and development. This is followed by a discussion of the problems with traditional costing in a contemporary world. The chapter moves on to contrast ABC with conventional approaches to allocation and focuses on the potential distortions which result from using traditional systems. The simplicity of traditional costing methods admits various distortions and underscores the need for new and innovative approaches to cost management (Johnson and Kaplan 1987a). However, not all organizations need to abandon old costing systems in favour of ABC. ABC is of particular benefit only when specific structural factors exist in the organization. It should be noted that ABC is far from a clear and concise body of knowledge, nor is it certain to what extent ABC is an alternative to more established approaches to cost management. The chapter concludes with a number of unresolved issues which draw questions about both the theory and practice of ABC. These factors are outlined and discussed. A glossary of basic terms is provided at the end of the chapter to assist the reader when confronted with ABC terminology used throughout the chapter and thesis.

2.2 THE EVOLUTION OF ABC

The evolution of ABC is difficult to encapsulate because there are many layers over its origins. Although its current popularity stems from the 1980's with the work of Cooper (1988a), there were previous advocates of the activity accounting approach to costing. Longman and Schiffs (1955) experimented with concepts such as "Functional Accounting", which supported the use of non-volume based cost drivers. They used work units to describe a collection of homogenous tasks and attempted to assign a common output produced by each unit which could explain the rate of resource consumption. In addition, Drucker (1963) introduced the idea of transactions as drivers for overhead costs. By investigating overhead in detail, the number of transactions were determined to be more proportional to the level of overhead costs than the physical number of units produced. This kind of analysis highlighted the role of complexity in determining product costs. However, at this time in history, accountants appeared more interested in unit costs rather than product costs. Almost ten years later activity accounting was introduced as "input-output accounting" (Staubus 1971). However, this application of the term "activity accounting" was unfortunately largely ignored both by the business community and by academics.

Pressure from the East (mainly Japan) led to increases in competition in the early 1980's, which in turn led to calls for management accounting reform (Johnson and Kaplan 1987a). It was no longer sufficient to earn a profit by focusing on cost. Quality, flexibility, and productivity were now the new measurement signals that management would focus upon in order to sustain a competitive advantage (Johnson 1988). Non-financial indicators consistent with long-term competitiveness were developed (Kaplan 1983, 1984).

From 1984, a series of papers highlighted the information distortions caused by the application of traditional product costing methods (Kaplan 1983, 1984, 1985, Miller and Vollmann 1985). The use of a single denominator as a method of allocating the total overhead was aggressively attacked. At the same time, the use of direct labour as the allocation base also became questionable as it encapsulated volume as a cost driver but excluded many other influences of costs. Johnson and Kaplan (1987a) argue that direct labour costs as a percentage of total cost has declined as firms invested more aggressively in automation. As a result, labour based overhead rates became increasingly large and resulted in an exaggeration of all the facilities of a solely volume based cost driver. Therefore, product cost distortions were magnified.

Traditional cost accounting's limitations had been clearly exposed. In response, in 1986 a consortium of progressive industrial organizations, professional accounting firms and government agencies was set up to define the role of cost management in the new competitive environment. This project was called the Computer Aided Manufacturing-International project (CAM-I). The efforts of the group resulted in an endorsement of activity accounting as a method of tracing cost more accurately, and as an approach to understanding overhead costs (Berliner and Brimson 1988). Their work drew on the results of a series of Harvard business school cases conducted by Kaplan and Cooper who were also experimenting with activity accounting (Kaplan, Union Pacific; Kaplan, John Deere; Cooper, Schrader Bellows). In 1987, the highly publicized book entitled "Relevance Lost: The Rise and Fall of Management accounting" captured the attention of academics and business professionals (Johnson and Kaplan 1987a). The book highlighted the problems with traditional costing methods, described above, as a constraint on western business performance. In particular, the authors criticized the dominance of financial accounting procedures, particularly to inventory stock valuation, as inhibiting the advancement of cost accounting contributing to its obsolescence (Kaplan 1985). Activity accounting was suggested to be an avenue for managing for long-term productivity as well an opportunity for academic research (Kaplan 1983, Johnson and Kaplan 1987b).

It was not until 1988 that ABC was seen as an extension of a two stage procedure (Cooper 1988a). In a series of articles by Cooper (1988a, 1988b, 1989a, 1989b) ABC was formally explained and illustrated. The articles outline how ABC works, why a new cost system may be needed, and discusses the use of cost drivers as a means of tracing cost to products. It demonstrated its application through a series of key Harvard Business School cases (Kaplan, Union Pacific; Kaplan, John Deere; Kaplan and Cooper, Shrader Bellows). The foundation of ABC as a plausible approach for product costing was etched into academic and professional journals for the next several years.

It was not until the 1990's that further significant refinements to ABC were made; firstly through the concept of cost hierarchies, and secondly through the role of capacity and the distinction between consumption and spending. Cooper (1990a) outlined the levels of cost variation as unit, batch, product and facility sustaining activity costs. This cost hierarchy helped to bridge the gap between the traditional dichotomy of fixed/variable and the new concept of cost variation based on transactions other than unit volume. The cost hierarchy also linked the continuous improvement and Total Quality Management (TQM) themes by advancing the notion of lean production activities (Kaplan 1994b). Increases in quality could be made through the examination of activities. Improvements in productivity could be accomplished by assessing the impact of changes in cost driver transactions. Cooper and Kaplan's (1992b) paper clarified the connection between spending and consumption.

ABC was designed to measure the demand placed on resources, rather than the level of resource supply. The difference between resource supplied and resources demanded represents the unused capacity of that resource (Cooper and Kaplan 1992b). This distinction between supply and demand of resources helped to clarify ABC's role in the budgeting process.

Two important applications of ABC information expanded its use as a performance evaluation tool. First, Bellis-Jones (1989) used activity information to assess customer profitability. The term "cost object" no longer meant "product" exclusively. In addition, Brimson and Fraser (1991) used activity cost systems to formulate activity related budgets. The acronym "ABB" was introduced into the new language of Activity-based systems.

The key literature contributions in the evolution of ABC can be categorized into four phases. They are; 1) early conceptions, 2) need for change, 3) establishment of ABC, and 4) applications and refinement. These phases are summarized in figure 2.1 below:

YEAR	PUBLICATION/EVENT	Significance to ABC
PHASE 1:	EARLY CONCEPTIONS	
1955	Longman and Schiff "Practical Distribution Cost Analysis"	Introduction of functional accounting
1963	Drucker, P. Harvard Business Review. "Managing for Business Effectiveness"	Introduction of transaction analysis
1971	Staubus, G. "Activity Accounting and Input-Output Accounting"	Introduction of Activity Accounting
PHASE 2:	NEED FOR CHANGE	
1983	Kaplan, R. The Accounting Review. "Measuring Manufacturing Performance: A New Challenge for Managerial Accounting ..."	Development of need for non-financial indicators
1984	Kaplan, R. Harvard Business Review. "Yesterdays Accounting Undermines Production"	Highlighted distortions in cost from traditional methods
1985	Miller, J. and Vollmann, T. "The Hidden Factory"	Introduced managing overheads by focusing on transactions
1986	Computer Aided Manufacturing-International is created	Introduces activity accounting as new method of allocation
PHASE 3:	ESTABLISHMENT OF ABC	
1986	Cooper, R. and Kaplan, R. Series of Harvard Business School case studies experimenting with activity analysis	Activity accounting experiments and product mix distortions
1987	Johnson, T. and Kaplan, R. "Relevance Lost. The Rise and Fall of Management Accounting"	Publicizes need for change and endorses activity accounting
1988	Berliner, C. and Brimson, J. "Cost Management for Todays Advanced Manufacturing"	Summarizes CAM-I project and concludes value of ABC
1988	Cooper, R. Journal of Cost Management. "The Rise of Activity Based Costing"	Clarifies and illustrates use of ABC
PHASE 4:	APPLICATIONS AND REFINEMENT	
1989	Bellis-Jones, R. Management Accounting. "Customer profit-ability Analysis"	Customer analysis using ABC is introduced
1990	Cooper, R. Journal of Cost Management. "Cost Classification in Unit-based and Activity Based Manufacturing Cost Systems"	Introduction of cost hierarchy
1991	Cooper, R. and Kaplan, R. Harvard Business Review. "Profit Priorities from Activity-Based Costing"	Introduced role of capacity
1991	Brimson, J. and Fraser, R. Management Accounting. "The Key Features of ABB"	Activity information is used for budgeting. ABB introduced

(Figure 2.1)

2.3 ACTIVITY-BASED COSTING DEFINED

ABC is a systematic approach to managing and allocating conversion costs through analysing activities. It has been insufficiently described as a technique simply for product costing (Cokins et al. 1993). A technique is a tailored method for solving a specific problem, such as the contribution margin approach. ABC is more than a technique because it has been applied to almost all the major areas of management accounting, such as inventory stock valuation, decision making, control, and performance measurement (Mitchell 1994a). ABC might more appropriately be described both as a theory of cost management and a costing approach. ABC can be used as an information base for decision making, as a means for analysing overhead, and for process improvement. ABC systems attempt to determine and use the factors which are driving cost. They use this to link costs to costs objects in a way which reasonably reflects resource consumption patterns. Therefore, both the theory and the technique are designed to improve the accuracy of costing products and services and to enhance understanding of how and why costs are incurred. This understanding can then provide a basis for managing costs. In order to understand the theory, the logic, and the technique of ABC, one must first understand the terminology used in its description. A new accounting language has emerged to support ABC concepts and applications. Most terms, however, are new ways of naming old and familiar ideas. A glossary of terms is provided at the end of this chapter for reference as needed.

2.3.1 ABC theory. Understanding the phenomenon of cost behaviour has long perplexed, frustrated, and captivated accountants and managers. There have been some more elaborate attempts (Drucker 1963; Staubus 1971) in the past at understanding the origins of cost behaviour within an organization, but none which have managed to inject generally accepted support. ABC is the first costing theory to achieve some degree of practical popularity which attempts to explain cost behaviour in terms of cause and effect.

If the cause of costs could be identified and understood, then managers would be better able to control and manage them. A model which relates costs to the forces behind them is the theme of ABC theory (Miller and Vollmann 1985). Just as in other fields of scientific research, understanding of a phenomenon is gained by the discovery of a deeper cause.

Miller and Vollmann (1985) describe the causes of many components of conversion costs in terms of transactions . Unit volume transactions (e.g. the production of more units of output) have long been considered a universal cause for cost increases. This assumed a single cause behind cost behaviour phenomenon. With the introduction of transaction analysis, four further transaction types are identified as causes for costs in addition to unit volume.

> 1. Logistical transactions. Transactions which facilitate the movement of materials. This includes transaction for ordering, receiving, inventory control and batch production preparation.
>
> 2. Balancing Transactions. These are transactions aimed at balancing the supply and demand of resources. Included in this category are transactions which relate to an adequate labour level, machines, materials and supply resources necessary to meet production demand requirements.
>
> 3. Quality transactions. Transactions which are directed towards insuring that specifications, standards, and certification requirements are satisfied.
>
> 4. Change transactions. These transactions are aimed at updating machinery, procedures, policies, products, and technology, to accommodate changes in the business environment and to improve the manner of doing business. These include transactions related to changing information systems, engineering design, schedules, and material specifications.

Transactions, as described above, occur as a result of work performed within the organization. Economic transactions identify a condition of exchange. The exchange is a process of transforming an input into an output. Each activity involves a transaction which is aimed at satisfying a certain objective. In order for the activity to occur, certain inputs are necessary to perform the activity. These inputs are than transformed to produce an output. For example, consider the activity of processing payroll cheques. The inputs for the activity are the payroll information and the supplies and equipment necessary for processing. The activity objective is to produce payroll cheques to compensate the employees of the company for work performed. The transaction is manifested at the time the input is transformed into output. The production of the payroll cheques is, therefore, the transaction of the exchange. The transactions which convert inputs into outputs provide the basis for the ABC theoretical framework. The theory of ABC is based on the premise that activities connect resources to products. The theory attempts to capture the essence of natural inputs and outputs of an organization (Staubus 1971). Outputs (products) cause activities to be performed and activities cause resources (inputs) to be incurred.

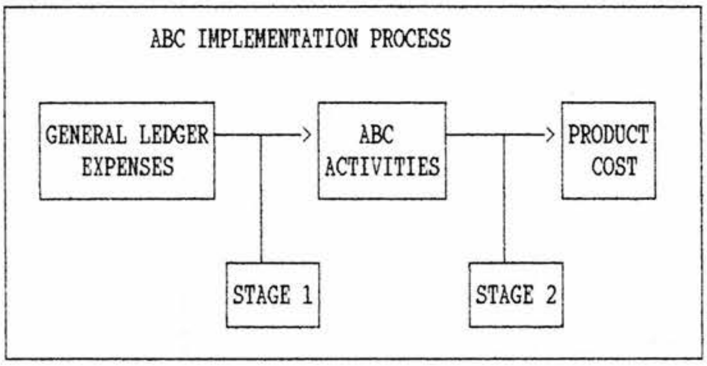
2.3.2 The orientation of ABC. In contrast to short-term decision oriented cost models, such as traditional variable costing, ABC adopts more of a long-term orientation. Because ABC information directs management's attention on resource consumption patterns rather than on spending patterns, there is a lag between usage and expense recognition (Cooper and Kaplan 1992b). Decisions are both diverse in nature and often involve complex interdependencies. Therefore, it is impractical to create individual decision models to address single decisions. For this reason, the resource consumption orientation of ABC appears superior to a spending model orientation because it captures the lag between resource consumption and subsequent changes in spending (Cooper 1990b). Cash flow information is reflected in long-term changes in the rate of usage, not in an immediate estimate of spending adjustments. The logic of ABC is found in a trade-off between simple theoretical models and practical realities. It may be appropriate to use a simple contribution margin model to estimate short-term changes in relevant costs, however, it must be understood that these simplistic models do not reflect the complex real world environment.

2.3.3 ABC costing technique. The ABC technique is designed to trace resource costs to the products or services in a two stage process. Stage one is the process of tracing expenses to activities resulting in derivation of activity costs. Stage two is the process of tracing activity costs to products or services resulting in product costs. To accommodate the chain of consumption, cost drivers are used to connect the input to outputs of each stage. In stage one, general ledger expenses are driven to activities using a multiple set of cost drivers. The appropriate cost driver depends on the relationship between the resource and the activity. The cost driver should reflect the rate of resource consumption. For product outputs the rate of consumption does not have to depend on unit volume as in traditional costing systems. The rate at which activities consume resources as well as the rate at which products consume activities may involve many different transactions and hence require numerous cost drivers. These can be viewed as confirming the cost hierarchy continuum of unit-level, batch-level, product-level, and facility-level put forward by Cooper (1990a).

2.4 THE GOAL OF ABC

The goal of an ABC system is both to determine an accurate product cost and to create an activity information base for analysing the business process. Process analysis is, in effect, a byproduct of an ABC system. The aim can be expressed both in technical terms and in broad managerial terms.

2.4.1 In technical terms. ABC is aimed at determining an accurate cost trail between resources and costs objects. This cost tracing trail is accomplished through the two stage process of allocation. Stage one involves the transformation of the general ledger costs into activity costs. Stage two involves transforming activity costs into product costs. The ABC process is briefly diagrammed in figure 2.2 below:



(Figure 2.2)

The aim is to determine the best way to trace or allocate general ledger expenses to activities, then find the best way to allocate or trace activity costs to the product. According to ABC theory, the best way to transform general ledger expenses into activity costs is to use a cause-and-effect link known as a cost driver. Cost drivers are used in stage one to transform general ledger expenses into activity costs and then again in stage two to transform activity costs into product costs. However, it should be noted that it is possible to stay at stage one and derive benefits from the activity analysis alone without calculating product costs in stage two.

2.4.2 In managerial terms. Ultimately the goal of ABC is to improve decision making by highlighting important aspects of product cost information. Burch (1994) outlines three basic goals of ABC. They are;

1. Appropriate pricing decisions based on good cost information.
2. Appropriate product mix decisions based on good profitability information.
3. Good cost management by focusing on activities and cost drivers.

However, as with any costing and management system, the effective benefits from its use determine the extent to which the system goals are achieved (Cooper 1990c).

2.5 THE MECHANICS OF AN ABC SYSTEM

Both traditional systems and ABC systems utilize a two stage process to trace or allocate resource costs down to the cost object. Although both systems require two stages, the processes differ substantially. ABC systems are more complex and require additional design attributes to build an effective model.

2.5.1 The traditional two stage process. An ABC system is an extension of the traditional two stage procedure used for most cost systems today (Cooper 1988a). In the first stage of a traditional system, resources are assigned to responsibility centres or functional departments of the company. In the second stage, the cost accumulated in the department or cost centre is allocated to the products and services produced by the organization. The objective of tracing costs to responsibility centres is to evaluate the performance of the managers within that functional area. Additionally, cost accumulation by functional departments is necessary to satisfy financial reporting requirements.

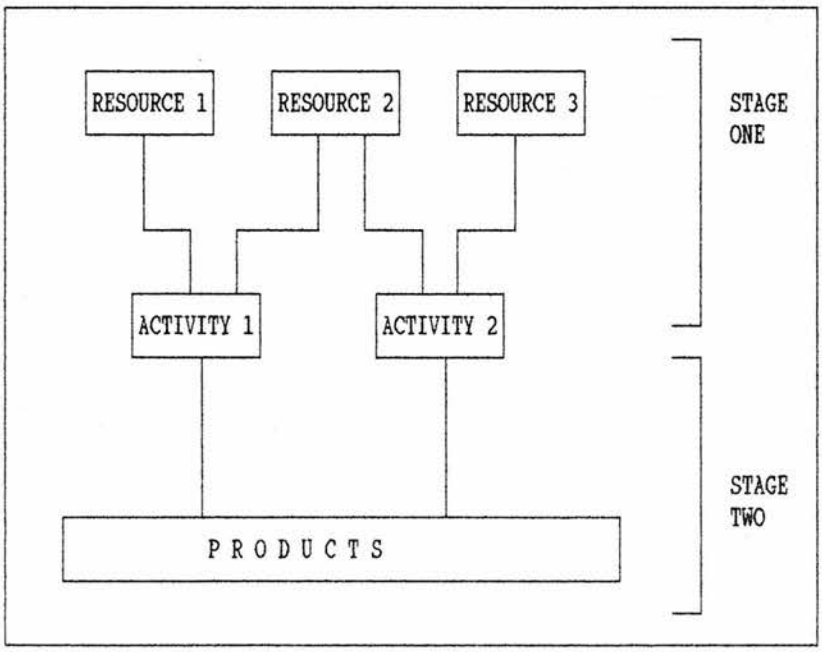
The second stage of the process requires departmental expenses to be allocated or traced to products or services. An allocation base is used to attempt to measure the costs associated with the products. Most systems rely on a few allocation bases such as Direct Labour, Machine Hours and Material Pounds (£) (Cooper and Kaplan 1991b). Although a number of different cost allocation bases can be used to spread the costs to products, they all assume an incremental relationship to the volume of production units. In other words, the cost assigned to a particular product will increase proportionately to the number of units produced no matter what cost driver is used. In contrast, ABC considers multiple levels of cost variability within a two stage process.

2.5.2 ABC's two stage process. There are three differences in the way ABC utilizes the two stage process to cost products. First, multiple cost drivers are used in each stage of the process. Second, each cost driver is a measure of variability with respect to some activity rate which may or may not be related to unit volume. Third, activities are considered to be performed across departmental lines. In the first stage, a "resource drivers" is used to trace expenses in the general ledger to activity centres (CAM-I Draft Document 1990). "Activity drivers" are used to trace the activity costs to cost objects in the second stage (Turney 1992).

At stage one, resource drivers serve as links between the resources in the general ledger and the work performed by the people in the organization. The purpose is to assign cost to effort. An appropriate cost driver should be an identifiable and quantifiable measure of resources consumed by activities. For example, Salaries Expense in the accounting department may be traced to the activity of preparing journal entries by an estimate of the amount of time each person in the department devotes to this activity. Each resource needs to be matched to an activity using a cost driver which properly captures the rate of resource consumption. For example, it would be difficult to justify using the number of journal entries as a cost driver to represent the rate at which the activity of preparing journal entries consumes salaries expense if each entry requires varying degrees of time and effort. Noreen (1991) suggests that in order for a cost driver to accurately represent the rate of resource consumption there must be a proportional linear relationship between resource and cost driver. However, in practice there appear to be very few cost driver relationships which meet this criteria (Cooper and Kaplan 1992a). Instead, firms implementing ABC have tended to judge cost driver relationships based on "usefulness" and "reasonableness" grounds (Turney 1992).

However, it is not necessary to consider each and every expense category separately. Expenses can be grouped into Cost Pools. A Cost Pool is a group of expenses which possess a relatively homogeneous cost behaviour. Brimson (1991) identifies a number of "natural expense categories" by which to use a single cost driver to trace costs to activities. For example, property related expenses could be traced by percentage of square footage, technology related expenses by machine hours or CPU (Central Processing Unit) time, and labour related expenses by head count. This makes the tracing process easier and more efficient.

Activity drivers serve the same function as resource drivers, but instead perform their function in the second stage of the process. Activity drivers trace activity costs to the cost object. Estimated measures of activity costs consumed by products are expressed through an identifiable measure of output. The level of effort directed toward producing output will differ among product lines. Complex product will require more support and a higher level of effort to accommodate its complexity. The level of cost should be matched proportionately to the level of effort devoted to each cost object. This is the key to an ABC system. More complex products which require more effort should have more cost assigned to them than simple products which require less effort and support. The problems with traditional systems is that product complexity is not captured through a unit-based concept of cost variability. The ABC two stage process is shown below in figure 2.3:



(Figure 2.3)

2.5.3 Design factors. An ABC system can be described in terms of the design factors which must be considered. Cooper (1989b) identifies five areas for managerial decision when defining an ABC system. They are:

1. Aggregating actions into activities. There are countless actions which occur within an organization. Tracing resources to each and every one of them would be extremely time consuming and expensive. Rather, broad significant activities should be composed of a collection of related detailed activities.

2. Reporting the cost of activities. There are many resources which can be consumed by a particular activity. The detail reflecting the cost composition of an activity depends on the purpose of the ABC system. Resource categories can be retained and reported as part of total activity costs or can be aggregated into single activity cost.

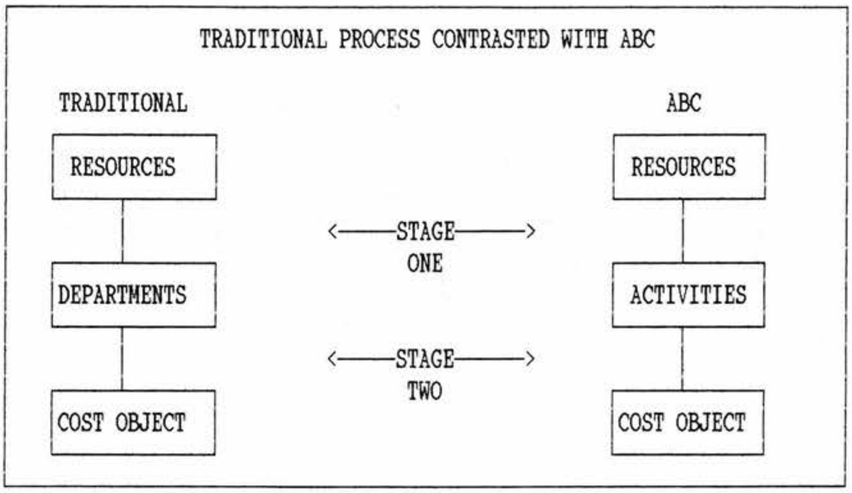
3. Selecting the first-stage allocation bases. When actions are aggregated into a single significant activity, it is assumed that each action consumes resources at the same rate. Although aggregation is necessary, to some extent, to make the system economically practical, the level of acceptable distortion must be assessed.

4. Identifying the activity centres. Activities which are aimed at a common goal can be grouped into activity centres. Management can determine the cost of an activity centre by summing the costs of each activity. Management must determine which activity centres it requires information about.

5. Selecting second-stage cost drivers. Tracing activity costs to the cost object requires activity drivers which estimate the amount of effort devoted to each product or service. The extent to which common activity drivers are used to trace various activities to cost objects determines the degree of distortion introduced into the product costs.

2.6 COMPARING ABC TO TRADITIONAL COSTING SYSTEMS

Traditional overheads costs have been applied on the basis of direct labour hours, machines hours, and direct labour pounds (£). These bases of allocation are applied to fixed and variable indirect costs in an attempt to attach them to products and derive a fully costed unit. The problem with this approach, however, is not with the allocation bases, but rather with the concept of variability. All indirect overhead costs are unitized based on the number of units produced. This assumes that costs can only vary proportionately with volume. This limited view of cost variability ignores the impact of product complexity and overhead cost behaviour. The figure 2.4 below contrasts the traditional approach with ABC:



(Figure 2.4)

2.6.1 Product complexity. Traditional costing systems can do a fair job of measuring resources consumed in proportion to the number of units produced with direct labour and materials. However they do not adequately measure the consumption of resources which support the growing level of organizational complexity of overhead costs which have little relationship with production volume (Innes and Mitchell 1990c). Product mix and diversity impacts the rate at which resources are consumed. For example, the cost of making a standard automobile in a streamline production line would consume much less resources per unit then a specially made car with custom design features.

2.6.2 Cost behaviour. The traditional notion of cost behaviour is viewed in terms of a fixed/variable dichotomy. A cost is variable if it approximates a positive linear relationship to production volume, and fixed if it does not. Fixed costs are seen as unchanging and largely uncontrollable at least in the short-term. If one looks over the last two decades, the costs which have increased the most are those costs labelled as fixed (Horngren 1990). In fact, all expenses are a result of management decision and therefore are controllable along some level of time horizon.

"Expenses are fixed only when managers fail to do anything to reduce them" (Cooper and Kaplan 1991a).

2.6.3 Cost hierarchies. Cooper (1990a) advanced the ABC concept of cost variability by suggesting that a structured level of a cost hierarchy existed in most companies. All traditional cost systems possess one thing in common. They all assign costs in strict proportion to production volume.

Cooper's approach assumes that not all overhead costs are consumed in proportion to unit volume. ABC systems recognize up to four other bases other than unit volume. These include batch-level, product-level and facility-level. Unit level activity costs are those which would approximately increment with the volume of units produced. An activity such as drilling holes on each part would be considered a unit-level activity cost because it is likely to vary proportionately with production volume. Batch-level variation occurs with such activities as setting up machines or ordering a group of parts for a production run. These costs are relatively independent of the number of units produced, but increment with respect to the number of batches. Product-sustaining activity costs are performed to support different product lines. Maintaining product specifications, performing engineering changes and expediting products are all examples of product sustaining activity costs. These costs can be assigned to product lines or groups, but they are relatively fixed in relation to production volume or number of batches. Product level costs can be incurred even if no unit production occurs at all.

While unit, batch, and product-sustaining activity costs may be reasonably assigned to individual products, facility-sustaining costs tend to be independent of product volume and mix in the short-term. General insurance, accounting services, and general administration are examples of facility-sustaining costs.

With ABC, all costs are considered to have potential variation within this cost hierarchy. Cost within one hierarchical level is likely to be fixed with respect to another level. It is assumed, however, that all cost within a specific hierarchical level will vary approximately in proportion to that level's activity cost driver. The ABC hierarchy can be summarized as follows:

1. Unit-based. Cost variation occurs in proportion to production volume.

2. Batch-based. Cost variation occurs in proportion to the number of batches in the production process.

3. Product-based. Cost variation occurs in proportion to product type changes, like design changes.

4. Facility-based. Cost variation occurs in proportion to changes in the general facility. These costs are generally considered fixed and only change if facility adjustments are made.

This hierarchical approach to cost variation is intended to provide an extension to the traditional highly simplistic fixed/variable categorization. It is not intended to provide managers with an absolute statistical correlation by which to calculate changes in costs, as Noreen (1991) insists, but rather a more realistic estimate by which to predict the outcome of managerial decisions and cost levels.

2.6.4 Activities. ABC interfaces resources with cost objects. Resources are directed to cost objects through the activities performed in the organization. By using activities as the interface between resources and cost objects, a more accurate level of effort can be incorporated into the allocation of costs to products or services produced (Brimson 1991). Traditional systems erroneously use a single cost driver, such as direct labour hours, to approximate the level of effort to accommodate the entire spectrum of overhead costs. By using various costs drivers to approximate the rate in which activities consume resources, a better estimate of product costs can be determined (Payne 1992).

Activity formulation is highly dependent upon the organizational goals and objectives of both the ABC system and the company as a whole. Activities could be defined in great detail or very broadly. If management places emphasis upon process improvement and cost management, then activities should be defined in detail. Process improvement is accomplished by analysing the activity connection within processes and across functional boundaries (Morrow and Hazell 1992). If product costing is the primary aim, then activities could be defined more broadly. The main concern is on creating activity cost pools with homogeneous cost drivers (Noreen 1991). For example, an activity may be defined broadly as; "processing payroll cheques" or it may be defined in more detail consisting of a number of separate activities such as, "inputting payroll information into computer", "printing the cheques" and finally "distributing the cheques". The formulation of activities, either in detail or in broad terms, is dependent upon the objectives of management as well as the creativity of the ABC system designers. However, it is likely that a firm would want to use ABC both for accurate product costs and for process improvement. In this case, management needs to balance the level of activity information detail to satisfy both aims.

2.6.5 Attributes. ABC utilizes coding schemes to turn qualitative attributes about cost information into manageable data than can be included in a decision making model (Walker 1991). Attributes are descriptive labels given to activity costs which provide an orderly way of categorizing qualitative variables (Drury 1989). In the past, limited technology precluded the efficient incorporation of qualitative data on a routine basis (Payne 1992). Collection was unmanageable and therefore it was simply excluded from most cost decision models (Glad 1993). Management accountants were left with unsystematic "ad hoc" methods, such as hunches and "gut feelings" to incorporate qualitative variables into the decision equation.

> "ABC attribute coding gives management an efficient and systematic avenue for the inclusion of qualitative variables into the decision making context and thus gives quantitative data intelligence."
>
> (Turney 1992)

Attributes provides multiple concurrent views with which to focus, prioritize, analyze and measure. Coding schemes promote creative ways to associate activities and attributes in a costing context (Walker 1991). Commonly used attributes include value-added/non-value-added, controllable/non-controllable, and cost-of-quality attributes. However, the type of attributes identified depends on management's aim.

2.7 THE DISTORTIONS OF TRADITIONAL COSTING METHODS

Like other management techniques such as Just-in-time (JIT), Total Quality Management (TQM) and Continuous Process Improvement, ABC is to some extent a repackaging of old ideas (Johnson and Kaplan 1987a). Although the basic ideas underlying ABC are simple, the nature of the cost objects, cost driver, and activities are complex and continually changing. The complexity, variety, and diversity of the business environment has increased greatly over the last two decades (Miller and Vollmann 1985). Use of advanced technology, changing distribution channels, new focus on quality, and the shortening of product life cycles all have contributed to the increased complexity of the business environment. As a result of this complexity, overhead costs have risen considerably as a percentage of total costs (Cooper and Kaplan 1991a).

Management accounting costing techniques have not kept pace with the changes in the business environment. As a result, product costs have become distorted, and managerial accounting information inadequate (Cooper 1990c). ABC is seen as a bridge closing the gap between the new complexity of the business environment and costing techniques (Koehler 1991). ABC converts cost information into a useable form which accountants and non-accountants can understand.

As business employed computer technology and invested in advanced capital assets, such as Material Requirements Planning (MRP) systems, Computer Aided Manufacturing (CAM), robots, and Process Simulation software, overhead costs have escalated dramatically. In the past, direct costs such as materials and labour have been the main focus of management accounting control. Now that overhead costs account for more of total costs than direct costs, it has gained increasing attention.

Budgeting, responsibility centres, and single denominator allocation schemes are typically used to control overhead costs today. These traditional approaches to controlling overhead costs are becoming less effective because of the growing dependencies among departments and functions and the relative decline in the level of direct costs. Controlling overhead costs by budgeting line-by-line analysis of the general ledger and assigning costs to each department tended to be more of a political process than a costing one (Covaleski and Dirsmith 1986, 1990b).

Over the last decade, the cross functional connection between departments has become a cornerstone to quality and productivity themes such as Process Cost Improvement (PCM) (Greenwood and Reeve 1994). The horizontal view of the ABC model depicts the relationship of connecting activities across functional lines in a series to perform a specific goal (Turney 1992).

The old notions of input-output accounting and transaction analysis have now regained popularity in the form of ABC. This new interest is a result of computer technology, the increased complexity of the business environment, and the resulting distortion produced by out-dated costing techniques. The proliferation in product mix, variety, complexity, and diversity as well as the displacement of direct labour and material costs by overhead, has overwhelmed traditional costing practices and has pushed management accounting into rethinking its approaches to product costing and overhead management.

Traditional volume based costing systems may result in significant product cost distortions, cross-subsidizing, and incorrect management decisions. Volume based allocation methods tended to ignore product diversity and complexity, which resulted in low-volume complex products to be under costed and high-volume simple products to be over costed (Turney 1992). Distortions in product costs, decision making, and overhead allocation are discussed below.

2.7.1 Distortion of product costs. Volume based systems do not adequately assign resource consumption to product costs. Although some costs such as direct materials and direct labour can be accurately traced to products using unit volume as an allocation base, many common costs shared among different products can not. This is because most overhead costs do not vary proportionately to production volume, but rather to some other variation base. For example, consider two products, product-A and product-B, both consuming a common overhead cost from the purchasing department. This is diagrammed in the figure 2.5:

PURCHASING DEPT. COSTS	£10,000
NO. OF PO'S:	
PRODUCT A	40
PRODUCT B	10
UNITS PRODUCED:	
PRODUCT A	2,000
PRODUCT B	6,000

VOLUME-BASED ALLOCATION:

PRODUCT A: £10,000 X (2000/8000)	£2,500
PRODUCT B: £10,000 X (6000/8000)	£7,500

ACTIVITY-BASED ALLOCATION:

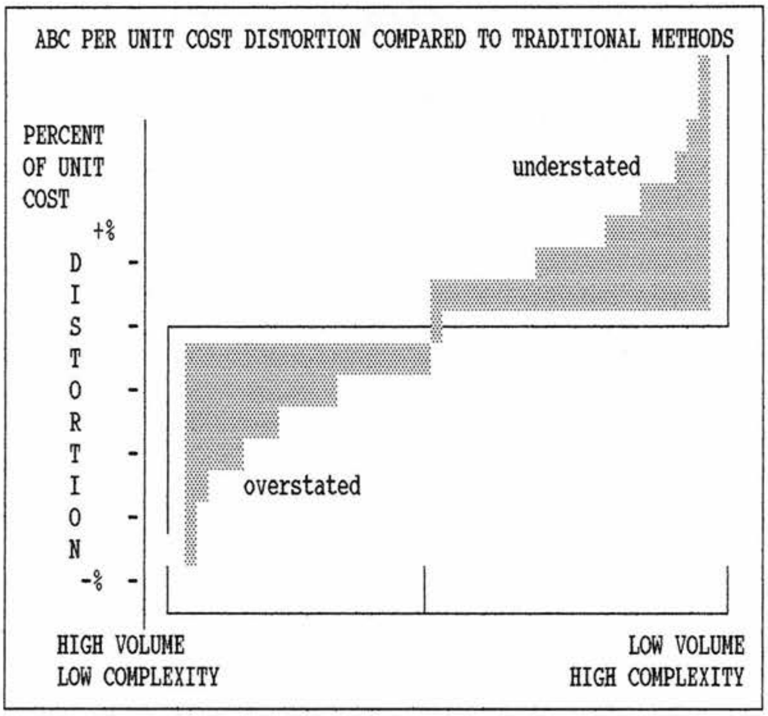
PRODUCT A: £10,000 X (40/50)	£8,000
PRODUCT B: £10,000 X (10/50)	£2,000

(Figure 2.5)

As can be seen from figure 2.5, traditional volume based allocation results in dramatically different product costs compared to ABC. Product-A requires 40 purchase orders compared with only ten for product-B. For proper cost allocation, purchasing department cost should charge 80% (40/50) of cost to product-A and 20% (10/50) to product-B. If total purchasing costs total £10,000, then £8,000 should be charged to producing product-A and £2000 for product-B. In contrast, using a volume based allocation system for overhead costs may result in just the opposite cost allocation to occur. If 2000 units of product-A and 6000 of product-B were produced in a given period, 25% (2000/8000) of the purchasing department costs would be allocated to product-A and 75% (6000/8000) to product-B. This would result in product-A being charged only £2,500 while product-B is charged £7,500. Clearly, using a volume allocation for products A and B results in a product cost distortion. The high unit volume of product-B is subsidizing the cost of producing the low volume product-A.

In several case studies involving the implementation of ABC systems (Cooper and Kaplan

1991b; Cooper and Kaplan 1992a), a trend in product cross-subsidation has been suggested. Those products which were simple to produce and which were produced in large quantities tended to be over-costed. In addition, those products which were more complex and produced in smaller volume tended to be under costed. The product cost distortion is diagrammed in the figure 2.6 below (Cokins 1992):



(Figure 2.6)

After ABC has been used to re-cost traditionally calculated product costs, the extent of the distortion is revealed. The height of the curve reflects the percentage of deviation of cost per unit of production that ABC has calculated compared to traditional calculations of product cost.

2.7.2 Distortions in decision making. Consider the contribution margin approach to short-term decision making. This approach is used widely to aid management in solving a number of common business problems such as make-or-buy and drop/add decisions. The traditional approach divides costs into either fixed or variable. Variable costs are those expenses categories which increment with production volume, such as direct labour, direct materials, and a variable portion of overhead. Fixed costs include all costs which are not classified as variable. These costs are expected to have no approximate linear relationship to production volume. However, forcing costs into a fixed or variable classification is likely to distort the predicted outcome and consequently result in erroneous decisions. This is because all the overhead costs labelled as variable may be fixed in relation to unit volume, but may be variable in relation to some other cost driver. ABC considers the possibility that other factors may contribute to changes in overhead. Rather than forcing costs into a fixed or variable classification, cost could be traced to activities which could be placed on the ABC cost hierarchy tiers of unit-based, batch-based, product-based or facility-based. Cooper's (1990a) cost hierarchy serves as a more complex representation of cost behaviour than the simple fixed/variable dichotomy.

2.7.3 Distortion in overhead allocation. The traditional approach to allocating overhead costs to products depends upon whether the direct costing approach or the full absorption method is used. Direct costing tends to be used for internal managerial purposes, and full absorption for external financial reporting (Burch 1994, Belkaoui 1991). Both methods adopt a volume-based allocation denominator to attach overhead costs to products which results in excessive distortion (Johnson and Kaplan 1987a; Cooper 1990b).

Direct costing determines the variable portion of overhead and adds this together with direct labour and materials to derive total variable costs. "Variable" in this case is defined as those costs which approximate a positive linear relationship with production volume. Unit costs can easily be determined by dividing the total variable costs by the number of units produced. Product cost predictions are simply a matter of multiplying the expected number of units produced by the predetermined unit cost. Because of the way in which "variable cost" is defined, all those costs which do not fluctuate with production volume are considered fixed. The term "fixed cost" implies that it is unchanging and irrelevant to short-term decision making. However, Kaplan (1990b) suggests that the problem with direct costing approach is that, with most companies, fixed costs keep growing.

> "It strikes us (Kaplan and Cooper) as peculiar that the costs which have varied (increased) the most are the costs that accountants have classified as fixed costs" (Kaplan 1990b).

The problem lies in the traditional definition of "variable". If a cost does not vary with production volume it may not necessarily be a fixed costs. ABC considers that most costs in the long-term are variable with respect to some cost driver. To illustrate the point, consider a company faced with a drop-or-add decision problem. The distortion is equal to the extent to which costs classified as fixed fluctuate with respect to some cost driver. This distortion produced by direct costing can be expressed in the following equation:

$$\text{TOTAL COST CHANGE} = \text{UNIT DIRECT COSTS} + \underbrace{\text{NON-UNIT VARIABLE COSTS}}_{\text{DISTORTION}}$$

Many companies have resisted, to some extent, the urging of academics to ignore fixed costs in short-term decisions. Most companies persist in allocating costs using some form of full absorption costing (Johnson and Kaplan 1987a). Johnson et al. (1990) suggests that the reason for this is because of the need to satisfy financial reporting requirements, and the managers' belief that fixed costs are relevant to production and decision making. Although there are some attractive features of a full costing approach, extensive arbitrary allocation reduces cost visibility and distorts the unit cost concept, which tends to mislead management.

2.8 THE APPROPRIATE ENVIRONMENT FOR ABC

If different products in an organization possess similar characteristics in terms of complexity and diversity, a singular volume based costing system may be easier to implement, providing a reasonably accurate product cost. However, if different products in a single organization consume resources at different rates due to differences in product complexity and diversity in marketing, production, and distribution, an ABC system may result in more accurate product costs (Burch 1994). Cooper (1988b) suggests that ABC systems are most appropriate when four factors are present. These are as follows:

Factor 1: When competition is high. The benefits of ABC can be most appreciated in a highly competitive market. When market competition is high, intense pressure is placed on prices which creates a need for more accurate costing tools. In addition, margins may be increased by increasing the price of some products while new market share could be captured by reducing the price on other products. Possessing accurate product cost in a competitive environment provides the basic tools for product strategy, positioning, and promotion.

Factor 2: When product mix is diverse. A singular cost allocation method, such as direct labour, is unlikely to capture accurate product costs when product mix is diverse in terms of batch sizes, physical size, raw materials, and the degree of complexity. ABC systems allow for multiple cost drivers which could be tailored to represent different aspects of each product composition. By using activities and multiple cost drivers to trace cost to products, there is less distortion than with traditional costing systems.

Factor 3: When product life-cycles are short. When product life-cycles are short, greater distortion occurs under volume based allocation systems. Volume based allocation methods exclude important non-volume related factors which impact production. Long-term production costs, such as factory buildings and capital equipment, are resources which are consumed by the conversion process. Ignoring these factors further distorts the costs which has implications for product design and production. ABC uses cost hierarchies (Cooper 1990a) which accommodate short-term and long-term cost variability factors.

Factor 4: When the transaction environment is computerized. ABC is highly reliant on electronic data processing equipment to collect and manipulate large amounts of information. In organizations where operations, transactions, and accounting information are highly automated, activity based information is more efficiently captured and utilized in an ABC system.

2.9 BASIC ISSUES OUTSTANDING

There are a number of issues relating to ABC which remain unsettled among academics and practitioners. These include the problem of short-term decision making, the role of capacity, concept of usage, and the basic definition of what constitutes an activity.

2.9.1 Short-term decisions. There is a long tradition of separating costs into fixed and variable categories for decision making purposes. It was relatively easy to describe fixed and variable costs in relation to production volume. Since ABC expands this dichotomy by introducing cost hierarchies which identify three other categories other than volume, the question of how cost will behave in the short-term becomes blurred. In short-term decision making such as make-or-buy, or drop-or-add decision, relevant cost must be determined and projected into the future. For example, sunk costs are excluded from relevant costs when making short-term decisions. It is unclear how ABC is able to accommodate the identification of relevant costs in short-term decisions. Much of the literature (Johnson and Kaplan 1987b, Kaplan 1990a, Turney 1992) describes ABC as a long-term decision model. The effective application of ABC concepts to short-term decision making remains unclear but will require the temporal classification of activity drivers. However, this may be difficult to generalize, and may require short-term analysis using ABC applied on a specific basis.

2.9.2 The role of capacity. The basic complaint of ABC systems is that measuring the output of various cost drivers would not result in an accurate prediction of input requirements. In fact, using cost drivers, such as the number of purchase orders processed, would consistently result in overstated expense predictions. For example, suppose the cost of processing a purchase order using ABC was determined to be £15,000, and the number of purchase orders is selected as the cost driver for this activity. If the number of purchase orders processed is 3000 then the cost per unit of cost driver is £5 (£15,000/3000). Predicting the cost of processing more purchase orders in the future could be computed simply by multiplying the expected number of purchase order by £5. For instance, if the number of purchase orders processed were expected to be 3500, the total cost of this activity should be £17,500. When practitioners applied this concept in practice, time and time again the cost of the activity resulted in overstatement of expenses when later compared to the actual result.

Cooper and Kaplan (1992b) recognized that both academics and practitioners were confusing two different cost concepts. When accountants asked how much expenses would change with respect to a certain decision, such as add-drop or buy-make, they were inquiring about organizational spending (Kaplan 1994b). Kaplan states that ABC systems were never intended to predict organizational spending. Rather, ABC systems were designed to merely measure the usage of resources. The link between usage (measured by ABC systems) and spending (measured by traditional systems) is the cost of excess capacity. Cooper and Kaplan (1992b) outlined the relationship between usage, spending, and capacity in the following equation:

$$\text{Cost of Resources Supplied} = \text{Cost of Resources Used} + \text{Cost of Unused Capacity}$$

Traditional financial systems measure the cost of resources supplied to the organization, while ABC systems measure the rate of demand placed upon those resources. The excess of resource supply over resource demand represents the cost of unused capacity (McNair 1994). Symptoms, such as shortages, late deliveries, and other bottlenecks indicate the possibility of an existing resource being stretched to capacity. When a resource is stretched to capacity, management has the option to increase resource supply or to find a way to reduce the rate of demand. The increase of supply is manifested in increases in expenses. Reductions to the rate of usage represent improvements in productivity. The theory of Activity Based Management (ABM) is based on the idea that management must first manage and control resource demand in order to manage and control resource supply (Kaplan 1994b).

The ultimate aim of most costing systems is to provide information about resource supply or spending. This is evidenced by the importance placed on net income measures of performance by shareholders, creditors, and managers. Since the main focus of ABC is upon resource usage, capacity estimates must be used to derive information about expenses. Although Cooper and Kaplan (1992b) identify capacity as the link between spending and usage, it is unclear how such concepts can be used to predict the supply requirements for a given decision problem. This issue of reconciling resource supply and demand is discussed further in Chapter five.

2.9.3 The concept of usage. The whole foundation of ABC is based on the concept of usage. One term which is often used interchangeably with "usage" is "consumption". As explained earlier, the theory of ABC is founded upon the idea that products consume activities and activities consume resources. However, how resources are actually consumed in the conversion process is not fully explained in the ABC literature. Cost drivers are used to measure the rate at which activities consume resources. The measure of consumption could be expressed either through a measure of time or a counting of transactions. For example, some cost drivers are based on transactions such as the number of invoices or the number of batch set-ups. Other cost drivers are based on time estimates needed to perform an activity. For example, salaries paid to employees to perform work is based on time. The amount of resource consumed by the employee is dependent upon the amount of time he or she is employed. However, simply measuring the amount of time a worker spends performing an activity provides little information about productivity. What extent productivity plays in the determination of resource consumption is absent in the research literature. The rate at which wage resources are consumed may not be significantly effected by a change in productivity of an individual employee and therefore, in this case productivity plays a limited role in resource consumption. In contrast, increases in productivity pervasive among many employees may permit the same job to be accomplished with less people and thus reduce the total wage expenditure requirement. In this case, productivity plays a significant role in reducing resource consumption. Higher productivity reduces consumption and in turn reduces the need for resource supply.

Clearly, productivity or some other measure of intensity of work has an impact on the rate of resource consumption. How these factors influence decision making, product costing, or process improvement has yet to be fully explained in the ABC literature. One possibility is to link ABC to cash-flow models that show the effect of resource consumption changes directly in terms of spending (Greenwood and Reeve 1994).

2.9.4 Activity formation. The manner in which activities are defined determines the effectiveness, usefulness, structure, and success of an ABC system. Most authors do not clearly explain what constitutes an ABC-activity. Often the same examples of activities are recycles from one publication to the next (Kaplan 1990a, 1994a, Cooper 1990a, 1990c, Brimson 1991, Turney 1992). Part of the reason for this lack of attention to activity formulation is the wide acceptance of a generic definition of what constitutes an ABC activity. For example, the following are definitions of activities are found in the literature:

> "An activity is work performed within an organization."
> (CAM-I 1990)

> "A unit of work performed within an organization. A description of work that goes on in the organization and consumes resources."
>
> (Turney 1992)

> "An Activity is what an organization does to convert inputs into outputs"
> (Burch 1994)

> "Activities are those actions needed to achieve the goals and objectives of the organization"
> (Berliner and Brimson 1988)

At most, a sentence or two is devoted to the definition of an activity followed by numerous examples of standard activities found in most organizations. Recent research by Turney (1992) suggests criteria for formulating activities for an ABC system (see Chapter twelve for further discussion of activity formulation). The research indicates that activities are not just tasks performed in the organization. Moreover, there is a distinction between the general use of the term "activity", and an activity used in an activity based cost system. ABC-activities must be formulated to support the aim of the ABC model and to drive resources down to cost objects. Turney (1992) suggests three criteria for the formulation of ABC-activities as follows;

1. The activity name must be phrased as an action sentence incorporating a verb.
2. The activity must be a significant identifiable aspect of work.
3. The activity must be processual in nature.

As will be discussed in Part 2 of this thesis, these criteria are still insufficient for effective activity formulation in practice. The ultimate purpose of using activities in an ABC system is to link resources to cost objects. Therefore, activities which do not serve this purpose must be reformulated or eliminated. For example, activities such as "answering the telephone" or "going to meetings" are clearly activities in the general use of the term, but they are not ABC-activities. The problem with these activities is they do not help in assigning resources to products. In Chapter twelve of this thesis, a technique for formulating "good" ABC-activities is suggested. However is not clear how much an ABC system designer should influence the process of formulating activities. There is a risk that important activities which do not meet the designer's criteria may be overlooked and excluded. To what extent activities should be designed or simply discovered is not clear. Moreover, the method of collecting activity information which facilitates the aims of an ABC system has yet to be explored.

2.10 CONCLUSION

As with most new ideas, ABC has developed over many years to take the form it possesses today. In some respects, old ideas have been repackaged into new "popularized" modern acronyms (Horngren 1990). ABC's slow development, with many contributors, adds to the firmness of its foundation as a new approach to cost management. Although development of modern ABC concepts have been introduced in the past, it was not until the late 1980's that academics and professionals began to take notice. The increasingly competitive environment, combined with leaders such as Kaplan and Cooper, helped to propel ABC into the accounting thought arena and inject vitality into the relatively static world of management accounting.

As researchers and professionals dig deeper into the meaning of activity-based information, new applications, new methods of implementation, and new uncertainties are raised about the validity of its present form. ABC continues to be an evolving theory and practice of cost management. It is not to be taken as a panacea for all traditional accounting shortcomings, nor should it be looked upon as a substitute for long established managerial accounting techniques. Rather, ABC should be considered another way of analysing costs to provide a new perspective for costing and cost management.

In the following chapter, the calculative structure of ABC is presented, followed by a step-by-step example to illustrate how a basic model is constructed.

Glossary of terms: Chapter two

Activity. An activity is a significant and identifiable conversion effort. It is a composition of related operations and tasks carried out to accomplish a company objective. An activity cost, therefore, is simply the cost associated with an activity. Activities in the accounting department might include maintaining the general ledger, preparing financial statements, performing credit checks, and conducting internal audits.

Cost object. A cost object could be a product, customer, market, or any other identifiable aspect of the business which requires knowing its cost.

Cost pool. A cost pool is a group of related general ledger expenses which possess similar behavioural characteristics. These groups might include labour costs, material costs, property costs, and technology costs.

Activity centre. An activity centre is a group of related activities which serve a homogenous purpose. This usually means a department or functional area of the company. Most general ledgers are already segregated into activity centres such as accounting, engineering, marketing, production, and administration.

Cost driver. The vehicle that moves cost from the general ledger to activities and then down to products is known as the cost driver. It is the basis by which costs are allocated or traced through the ABC model. The term "trace" is used when a reasonable cause and effect relationship exists. The term "allocate" is used in a traditional sense when arbitrary assignment is required. A cost driver is the most reasonable denominator for calculating a cause-and-effect measure of cost variability. Variability in an ABC system is not restricted to unit-level variation. It may include many cost drivers that have little relationship to production volume.

Resource. Resources are all the expense categories contained within the general ledger.

Cost hierarchy. The term cost hierarchy refers to the levels of cost variation. Activities tend to consume resources according to one of four cost variation levels. These levels include unit, batch, product and facility.

Examples of each term are presented in figure 2.7 below:

RESOURCES
utilities expense
advertising expense
production wages
depreciation expense
interest expense
freight expense
cost of materials
administrative salaries
data processing expense
payroll taxes

ACTIVITIES
processing purchase orders
processing accounts payable
receiving materials
maintaining the facility
preparing sales forecasts
counting inventory
handling customer complaints
testing for product defects
making sales calls
loading materials into machine

COST DRIVERS
number of PO line items
number of stock room transfers
number of labour hours
number of complaints
number of batch set ups for production
sales volume
number of units produced
number of engineering changes
square footage
number of stock transfers

ACTIVITY CENTRES
production dept.
customer adm. dept.
purchasing dept.
transportation dept
human resource dept.
accounting dept.
information sys dept.
quality control dept.
sales dept.
administration

COST POOLS	
Material:	Property:
purchases	rent expense
packaging	real estate taxes
transportation-in	building depreciation
Labour:	Transportation:
production wages	sales travel
salaries	transportation-out
bonuses	distribution fees
payroll taxes	auto depreciation
unemployment taxes	duty

COST HIERARCHIES
Unit level
batch level
product level
facility level

(Figure 2.7)

CHAPTER THREE

THE CALCULATIVE STRUCTURE

3.1 INTRODUCTION

Implementing a complex new cost management system into an equally complex business context gives scope for considerable variation in approach. The way in which activities are formulated and defined, the structure of the existing cost system, the data collection capability, and the purpose and motivations for implementation, all impact the design, structure, constitution, and installation of the ABC system.

This chapter begins with an introduction of the basic implementation process structure at a technical level, supplemented with an in-depth detailed illustrative example. The basic implementation structure is the essential process of transforming the general ledger into activity costs and then transforming activity costs into product costs. Subsequently, possible "progression patterns" and "implementation paths" (Friedman and Lyne 1995) are outlined, underscoring the wide variation in organizational needs, purposes, and interpretation.

The practical procedures necessary for implementation are glossed over in general terms in the literature by statements such as:

> "Pool activities together which have a common cost driver link"
> (Cooper and Kaplan 1992a)
>
> "Trace indirect activity costs through activities and direct activity costs to products"
> (Cokins et al. 1993)
>
> "Collect resources into natural expense categories and trace them to activities using resource costs drivers."
> (Brimson 1991)

This chapter is aimed at unravelling the practical complexities of implementing ABC and will be used as a reference point for the remainder of this thesis. The narrative nature of this chapter is intended to facilitate the reader's understanding of the complex nature of the implementation steps required to construct an ABC model.

3.2 BASIC IMPLEMENTATION PROCESS

Much of the literature has addressed the conceptual and theoretical aspects of activity-based costing (Johnson 1988, Cooper 1990c, Kaplan 1990a, Cooper and Kaplan 1991b, 1992a). However, none have provided detailed guidance on the means of moving from the general ledger through the ABC model and down to the final cost objects. A theory can often be more fully understood when it has been explained through practical illustration and example. Therefore, a practical illustration is used in this chapter to identify the practical steps and difficulties in operationalizing ABC. The approach described was that employed by the case study subject (Chapters 11 through 14) where the author undertook a participant observation study. Although based on one case experience, it does address general practical problems and is based on the application of one of the most popular ABC computer software packages, namely ABC Power, a product of Armstrong Laing Systems Ltd.

This chapter is organized into two stages. Stage one is a step by step explanation of how to turn general ledger information into ABC information. The focus is on the technical problems associated with preparing the general ledger, and calculating activity costs. Stage two of the implementation process is concerned with tracing activity costs to the final costs objects or products. There are many other problems and issues concerning the implementation of ABC, such as training issues, behavioural concerns, determining and defining activities, and managing the change process. These issues are addressed in later chapters.

Once a commitment has been made to apply ABC, the problem becomes one of how to get from the present system to an ABC system. This section provides such an explanation.

The general ledger is a prime source of cost data for most companies. It provides a widely accepted and understood framework for recording the transactions and events of an organization and as a basis for the preparation of conventional financial statements (Aitken 1991). However, the general ledger can be subjected to criticism because, although it does a good job of reporting and tracking financial condition, it fails to inform management of how to manage and control costs and how to accurately determine product costs. ABC is a costing tool as well as a management information tool, that attempts to overcome this problem by translating the cost information in the general ledger into useful activity based information. This new information provides the basis for accurately determining output cost and for analysing the cost of the conversion process. The management of costs is facilitated by an understanding of how resources are consumed. ABC translates general ledger input-oriented information into an informative profile of how resources have been used within the organization.

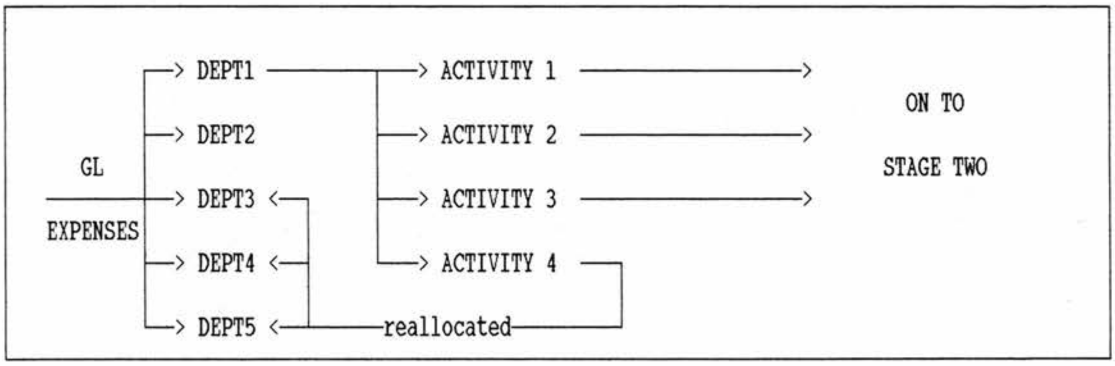
3.3 LOOKING FORWARD OR LOOKING BACKWARD

Given this capability, an ABC system can be used to analyze past performance or to project future events. In order to use ABC to project into the future, new information about resource supply, capacity, and consumption must be gathered. This can be based on an analysis of ABC models from the recent past. By analysing past performance, a company has the opportunity to discover important information about resource consumption such as various cost drivers, cost pools, activities, capacity standards, and resource usage rates. Once a clear understanding of these factors has been established, ABC can then serve as a valuable projection tool. The illustration which follows explains how to analyze past performance through ABC by transforming conventional general ledger information into activity based information.

3.4 STAGE 1: TRANSFORMING GENERAL LEDGER COSTS INTO ACTIVITY COSTS

Transforming the general ledger into activity costs is problematic because a general ledger system and an activity-based system are based on two different aspects of costs measurement. The general ledger is input-based and ABC is consumption-based. Cooper and Kaplan (1992b) suggest that the general ledger measures the level of resource supply to the organization, while an ABC system measures the rate of resource demand. For example, the general ledger records the input of purchasing related resources as "wage expense" and "purchasing supplies expense". The ABC system records the usage of that resource by counting the number of purchase orders which are processed. The excess of resource input over resource usage is excess capacity (Kaplan 1994b). Reconciling these two systems is a subject discussed more fully in Chapter five.

Stage one of the ABC process involves getting from the general ledger to activity costs. Essentially, the aim is to trace or allocate general ledger expenses to activities using appropriate cost drivers. The flow of information is diagrammed in figure 3.1:



(figure 3.1)

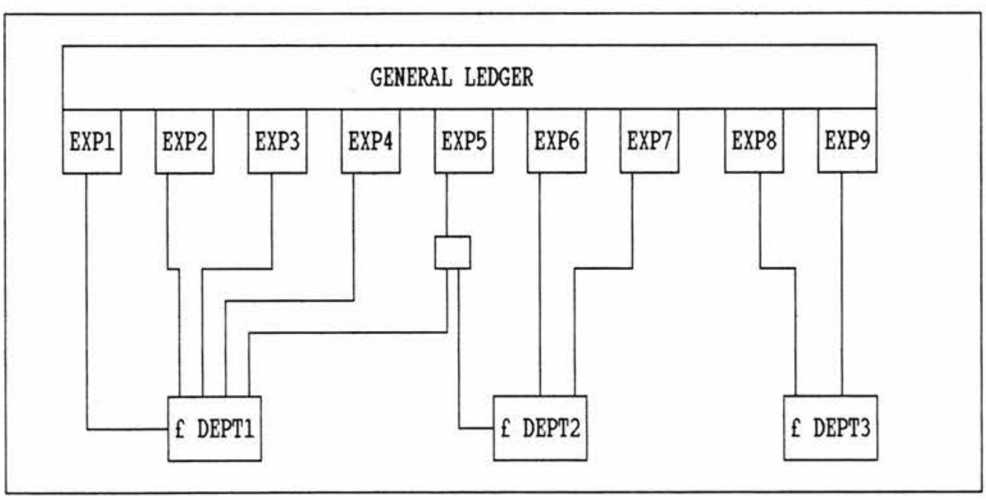
Note in figure 3.1 that one of the departmental activities is re-allocated back to other departments. This is required when an activity is performed to support other departments rather than being associated with the cost objects. To see how and why this is done, this problem is built into the illustration in the latter half of this chapter. Stage one requires five steps as follows:

1. Group general ledger expenses by activity centres.
2. Group departmental expenses into cost pools.
3. Determine departmental activities.
4. Code activities with cost hierarchy levels.
5. Trace or allocate departmental cost pools to departmental activities.

3.4.1 Step 1: Group expense by activity centres. Most of the literature suggests that activities cross functional lines and are therefore transparent to traditional departmental boundaries (Ostrenga 1990). For example, the purchasing activity is performed in a number of different functional departments. However, in practice, identifying activities without departmental boundaries is rather difficult. This is because activities originate within a bounded area of the organization, and are performed by workers associated with a particular department to achieve departmental aims (Morrow and Scott 1989). In addition, most general ledgers are already grouped by department to aid in the preparation of financial statements (Jeans and Morrow 1989). Therefore, in this illustration, the activity centre is synonymous with department.

Unfortunately, it is unlikely that all expense categories have been traced to the department which uses them. There are many common costs, (such as building rent), which may have been assigned completely to the administration department, but which are used by many other departments (Zimmerman 1979). Assigning common resources to different activity centres requires an appropriate cost driver to properly allocate these costs among departments which utilize them. For example, building rent might be allocated to other departments by the percentage of square feet occupied.

An appropriate cost driver is one that best approximates the cause-and-effect consumption pattern of a resource by a department. Some expense categories are likely to be neither assignable directly nor allocatable through cost drivers (Smith 1994). In this case, some form of managerial judgement must be exercised. If the expense is insignificant it may be appropriate to assign it completely to a single department. If it has a material impact, then some arbitrary allocation scheme must be used (Frame and Stevenson 1986). It is important to note that absolute accuracy is not necessary to obtain the benefits of an ABC system. Step one is diagrammed below in figure 3.2:



(Figure 3.2)

Formulating the activity model around departmental boundaries provides focus for identifying and collecting activity information. Although contrary to existing ABC protocol, it is a practically orientated solution to a complex data collection problem. However, it remains an important benefit of ABC to view activities which cross functional boundaries. This can be accomplished by linking together related departmental activities which are aimed at similar outputs. This is discussed in detail in Chapter 12, therefore, for the sake of simplicity and clarity, this issue is not addressed in the illustrated example presented in the later half of this chapter.

3.4.2 Step 2: Create cost pools. Once expenses have been properly traced or allocated to departments, cost pools must be established. A cost pool is a group of related expenses which possess similar behaviour patterns. By grouping costs into like-kind categories, fewer cost drivers are required for tracing costs to activities (Brimson 1988b). Typical cost pools include **material**, **labour**, **property**, and **technology**. According to Brimson (1988b), cost pools serve two functions:

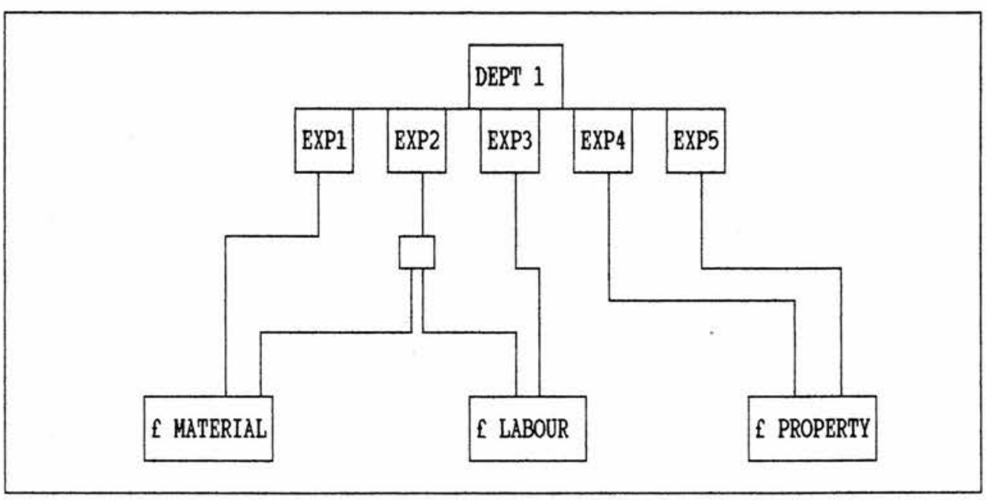
1. To simplify the tracing of departmental costs to activities.
2. To aid in the development of an appropriate cost driver.

As with any classifying process, it is unlikely that all departmental expenses will fit neatly into a cost pool. It may be necessary to create a new cost pool to accommodate a group of expenses. There are no set rules on this. A cost pool is simply a tool to facilitate the tracing process. If expense categories do not fit into a cost pool they may still be traced or allocated to activities on their own. If appropriate, it may be desirable to trace an expense to several or all departmental cost pools using an appropriate cost driver. If a cost driver can not be established, an arbitrary method of allocation may be used.

A **material** cost pool would include all the accounts classified as Cost of Goods Manufactured, such as purchases, packaging and transportation-in. It may also include those costs associated with purchasing related costs, receiving costs and accounts payable, and processing related costs. To correctly reflect the consumption of materials, only the cost of materials incorporated into the conversion process must be included in the tracing process and the ABC system. However, the manufacturing work-in-process inventory reflects material consumption, but it does not affect income until it is sold. If the ABC system is to be reconciled with net income then only the cost of material actually sold should be included. In the illustrated example presented in the later half of this chapter, the problem of "produced but unsold goods" is eliminated to improve the flow of the illustration.

The **labour** cost pool would be composed of all expense categories associated with employee wages and is therefore driven by employee related costs drivers, such as head-count or labour hours. It would include all salaries and wages as well as bonuses, payroll taxes, and miscellaneous employee benefits.

The **property** cost pool would be composed of all facility related expenses categories. It would include rent expense, property insurance, real estate taxes, and any other expense category related to the acquisition and maintenance of property assets. Step two is diagrammed below in figure 3.3:



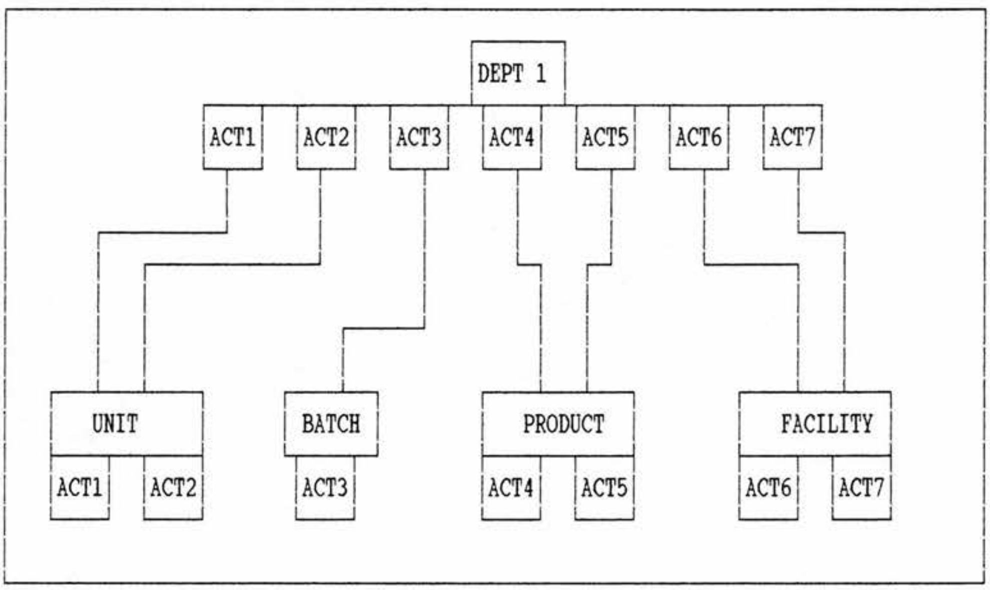
(Figure 3.3)

3.4.3 Step 3: Determine department activities. "Activities" describes work performed within a department. Activity classification should be specific enough to facilitate the tracing of costs and broad enough to promote cost effectiveness for the implementation. An activity is an identifiable segment of work performed to accomplish a specific company objective (Johnson 1990). As a rule of thumb, an activity could be a unit of work with cohesiveness which would make it possible to contract out to an external provider (Booth 1992). Typical activities in the accounting department might include preparing financial statements, maintaining the general ledger, performing cost studies and recording transactions. It is typical to select up to around a dozen activities within departments (Cooper and Kaplan 1992a). More activities than this are likely to unnecessarily complicate the ABC system and decrease the cost effectiveness of it. However, care must be taken to represent all primary activities within the department to safeguard the system's validity. A complete discussion on specific criteria for formulating activities in provided in Chapter 13.

3.4.4 Step 4: Code activities with cost hierarchy levels. Cooper (1990a) suggests that activities must be classified into an appropriate cost hierarchy. A cost hierarchy enhances ABC information by reflecting the activity cost variability level. Each activity consumes resources according to some level of cost variation. Typical levels of cost variation include unit-level, batch-level, product-level, and facility-level (Cooper 1990a). Rather than using the traditional separation of costs into fixed and variable, ABC identifies a more detailed vision of cost variability through multiple cost variation levels.

To determine the appropriate hierarchical level for an activity, it is necessary to determine which level is likely to be most influential in causing changes in the activity rate of consumption of resources. For example, increasing the unit production is likely to cause increases in production activities such as drilling, machining, or inspecting of parts. However, an activity such as setting up a machine for a job, may be independent of the number of units produced. This activity is likely to be influenced more directly by the number of batches required rather than volume parts produced.

It is not always clear which hierarchical level is most appropriate for a given activity. It is possible for an activity to be too broad and, in fact, encompass several sub-activities which may possess different variability patterns. If the activity can not be decomposed for proper classification, a managerial judgement may be necessary to make the best classification possible. Steps four and five are diagrammed below in figure 3.4:



(Figure 3.4)

3.4.5 Step 5: Assign cost pools to activities. At this point all departmental expenses have been grouped into cost pools and all activities performed within each department have been identified and coded with cost variation levels. It is now a matter of finding the best way to trace or allocate cost pools to activities. This is accomplished by establishing a reasonable cause-and-effect link between each cost pool and each activity (Ayres 1988).

This is accomplished by investigating operational details of the organization for possible transaction events which could be used to accurately measure the consumption of resources by a given activity (Pattison and Arendt 1994). Cost drivers are used to approximate this causal link (Babad and Balachandran 1993). The aim is to reflect as accurately as possible the activity's proportionate consumption of resources through a practical, numerically controllable, measure of output (Glad 1993).

Since cost pools contain expenses which possess similar behaviour patterns, only one cost driver is necessary to drive the resources in a cost pool to activities. For example, the labour cost pool may be driven to activities by percentage of time required to execute each activity. Transportation cost may be driven to activities by a distance measure. The property cost pool may be driven to activities by percentage of floor space occupied (Brimson 1991). If more than one cost driver can be identified as appropriate for a given cost pool, then the cost pool may need to be decomposed into separate pools. If no causal relationship exists between a cost pool and activities, then either the cost pool needs to be redefined or an arbitrary allocation method must be established.

Some cost pools will need to be assigned to only one or two activities. Others may have to be spread over all of the departmental activities (Banker and Johnson 1988). The hierarchical coding of activities serves as an aid to determining the appropriate cost driver. Unit-level activities require unit variable cost drivers, while batch-level activities require batch variable cost drivers (Cooper 1990a). Not all drivers will easily be classified into one of the hierarchical levels. In this case, managerial judgement is required to determine the best available driver and cost variation base. Figure 3.5 lists typical cost drivers and their corresponding variation base:

COST DRIVERS AND VARIATION BASES

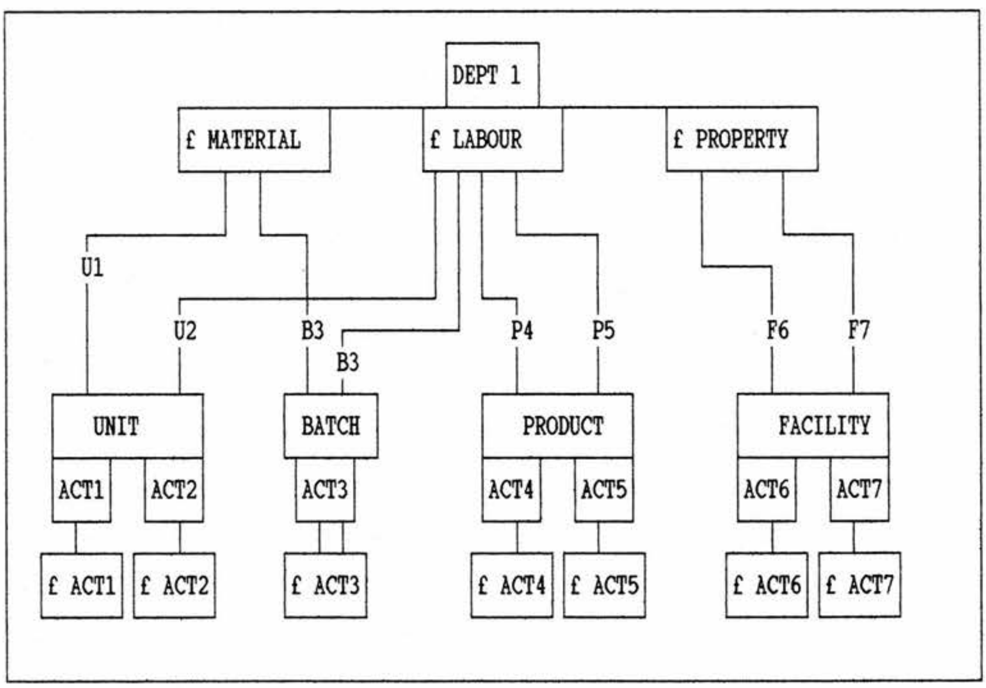
	BASE		BASE
Direct labour hours	U	Cost of goods sold value	P
Machine hours	U	Number of product shipments	P
Sales value	U	Number of receiving tickets	P
Number of inspections	U	Number of purchase orders	P
Number of tests performed	U	Percentage of floor space	F
Number of parts produced	U	percentage of facility expenditure	F
Number of part purchased	U		
Number of product orders	B		
Number of machine set ups	B		
Set up hours	B		
Number of material handling	B		

U = unit variation base   P = product variation base
B = batch variation base   F = facility variation base

(Figure 3.5)

(Cooper 1990a)

Step five is diagrammed in figure 3.6 below:



(Figure 3.6)

Step five is the last operation to complete stage one of the implementation process. At the completion of this stage, all general ledger expenses are traced to all the activities in the organization, resulting in a cost for each activity performed.

3.5 STAGE 2: TRANSFORMING ACTIVITY COSTS INTO PRODUCT COSTS

Stage two of the ABC process involves getting from activity costs to the final cost object or product (Innes and Mitchell 1991b). Essentially, the aim is to trace or allocate activity costs within each department to products using appropriate cost drivers. The logic of ABC is that activities consume resources (general ledger expenses), and products (cost objects) consume activities (Cooper 1990b). Stage one (described above) calculated the activity consumption of resources. In stage two, the aim is to approximate the consumption of activity costs by products (cost objects) using cost drivers again (Kaplan 1990a). Stage two requires five steps as follows:

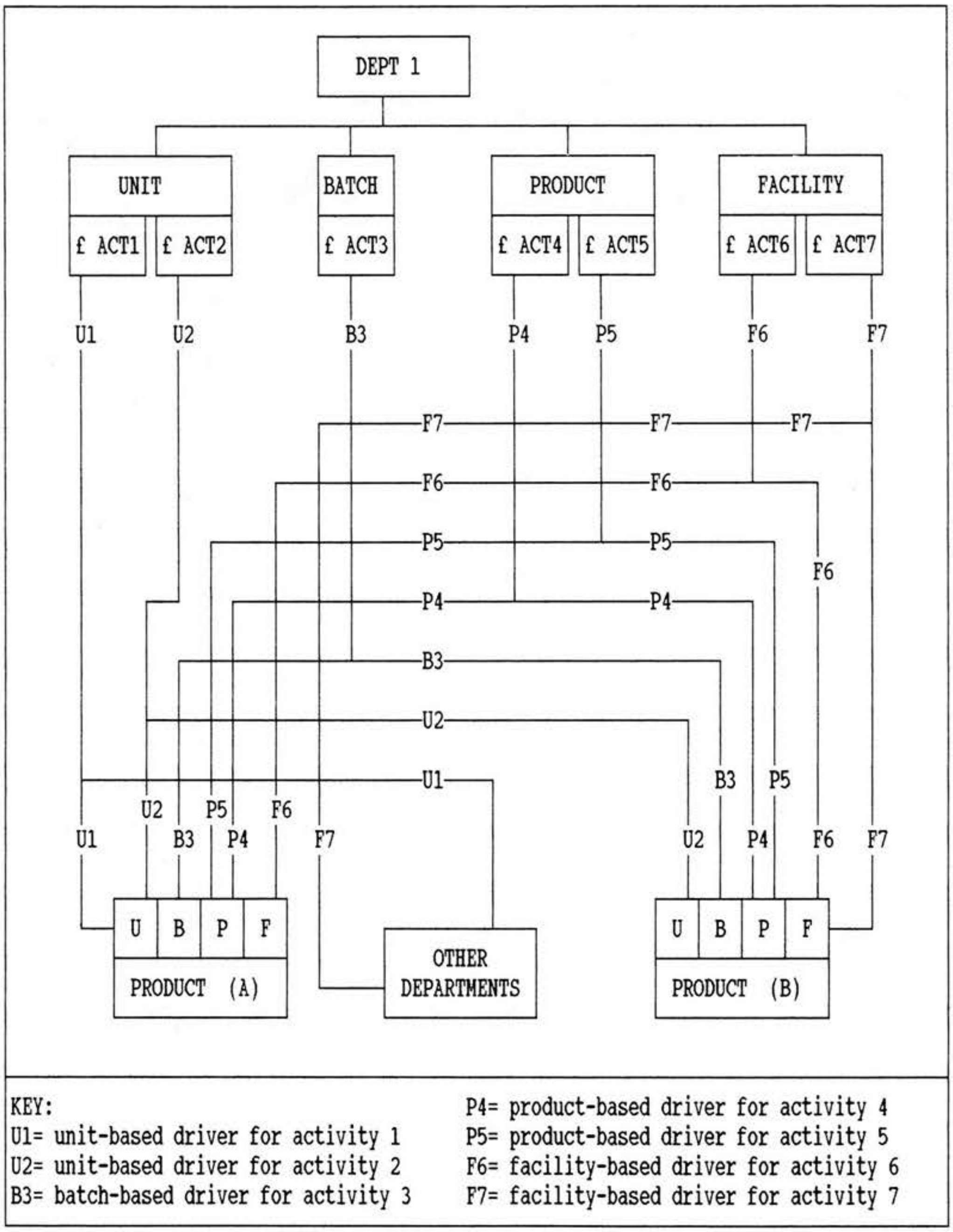
1. Trace activity costs to products using cost drivers.
2. Determine cost hierarchy totals by product.
3. Unitize all level of cost.
4. Reconcile costs.
5. Report product cost using full disclosure of cost hierarchy.

3.5.1 Step 1: Trace activity cost to products. In stage two the number of cost drivers is likely to be greater. In stage one, only one cost driver was required for a limited number of cost pools (Bailey 1991). In stage two, every activity must have a cost driver to trace it to the product. An activity cost may be either **direct** or **indirect** with respect to the cost object. An activity cost is direct when the activity is directly related and traceable to the cost objects. Direct activities would include the activity of processing parts in a manufacturing process or answering customer queries for particular products. An activity is indirect when its prime purpose is to support organizational functions rather than products. Indirect activities can not easily be traced to cost objects, but can more easily be traced to other departments or cost centres which they support. For example, the activity of receiving and distributing the company mail would be very difficult, if not impossible, to trace to a specific product. However, this activity clearly supports other departments and could easily be allocated to those cost centres that receive mail services. If an activity can not be classified as either direct or indirect, it is likely that the activity needs to be reformulated.

Care must be exercised in the selection of cost drivers so that the cost driver is consistent with the cost hierarchy level of the activity. That is, unit-level activities require a cost driver which will vary with production volume. In addition, Foster and Gupta (1990), and Fox (1991), argue that not all activities will reveal a logical cause-and-effect consumption pattern. For example, facility-level activities tend to be period related rather than product related. Therefore, most activities in this category will require a systematic allocation scheme which may not necessarily reflect the product consumption pattern.

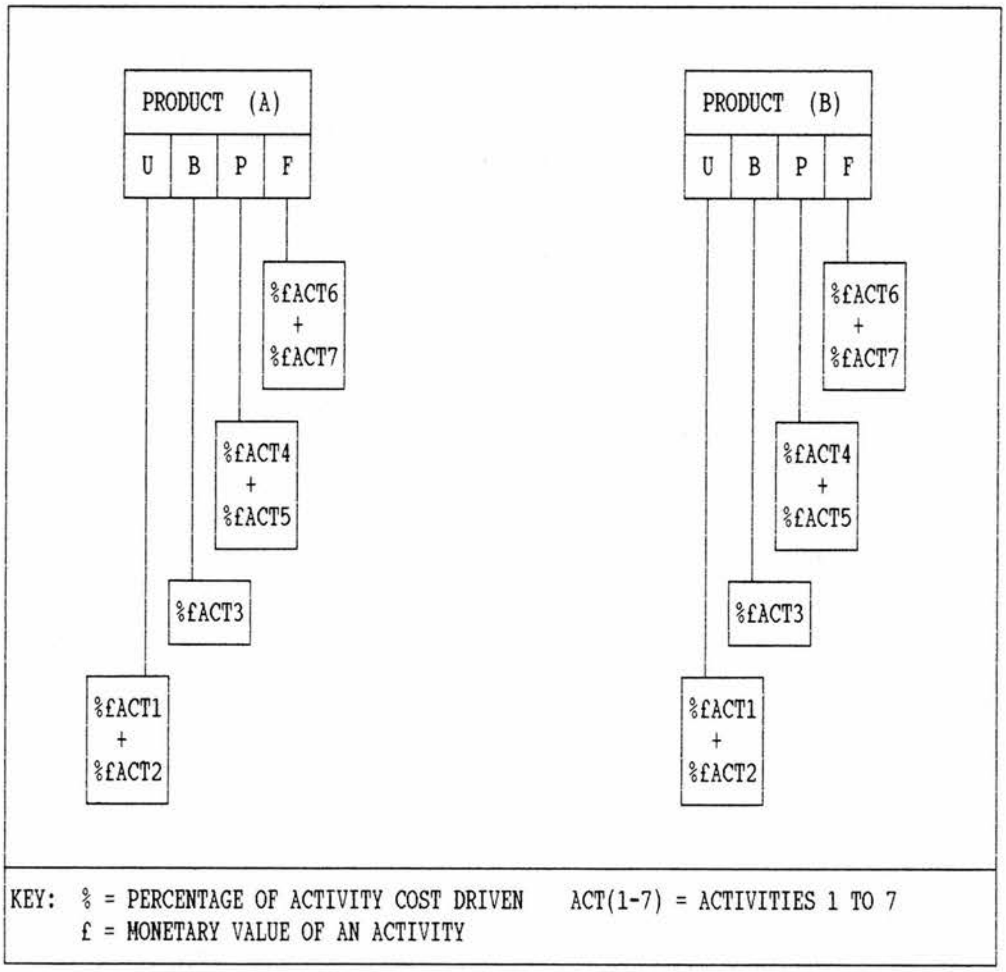
Each department's activities are traced or allocated to an identified cost object or to cost centres. However, Armatage (1993) points out that it is not necessary to trace every activity to every product. This is because some activities may only be consumed by one product while others may be consumed by many. However, in order to reconcile the ABC system with the general ledger and net income, every activity cost in every department must be traced or allocated directly to at least one product, or indirectly to at least one cost centre. The logic is that every activity must inherently possess some relationship to the output of the organization, be it either product or cost centre.

When an indirect activity is traced back to other departments this is referred to as a re-allocation process. The same cost driver information may be used to accomplish the original allocation or a new method may be used. Once the resident activity costs of a department have been adjusted for imported re-allocated activity costs from another department, the process of tracing activity costs to products is the same as that described above. Step one is diagrammed below in figure 3.7:



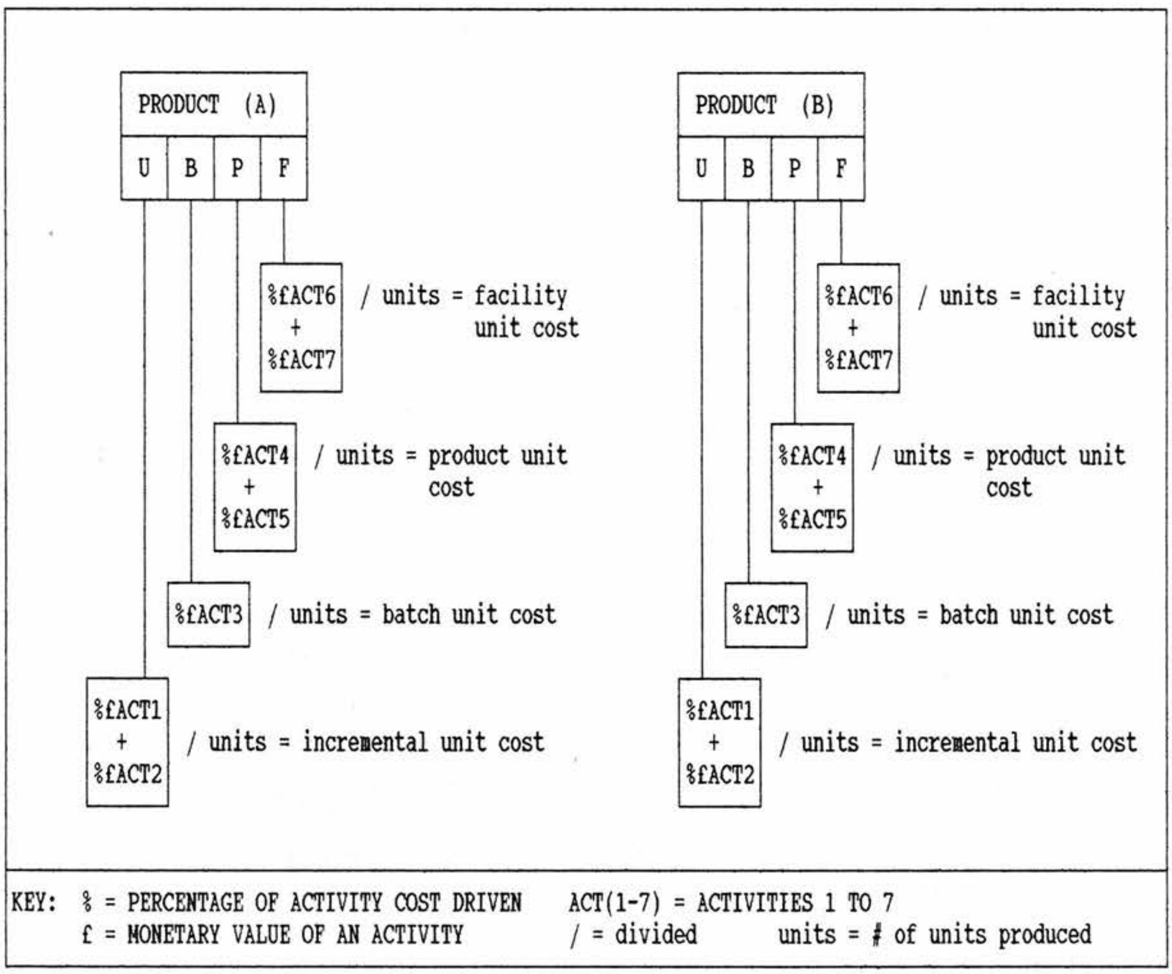
(Figure 3.7)

3.5.2 Step 2: Determine each product's cost hierarchy subtotals. When tracing or allocating activity costs to product lines, it is important to maintain the integrity of the cost hierarchy variation level (Banker and Johnson 1993). That is, all unit-level cost traced to a product must retain a unit-level classification (Cooper 1990a). This is necessary to properly reflect the cost behaviour components of a fully absorbed product cost. Cost hierarchy subtotals are calculated by adding the percentage of activity costs for each cost hierarchy level which has been traced to a specific product. For example, in figure 3.7 product (A) has two unit-level activities driven to it by cost driver U1 and U2. The percentage of activity-1 added to the percentage of activity-2 equals the total unit-level cost driven to product (A). Step two is diagrammed in figure 3.8 below:



(Figure 3.8)

3.5.3 Step 3: Unitize all levels of cost. ABC theory identifies at least four levels of cost (Cooper 1990a). Each level purports to have a general variation level. Batch-level, product-level, and facility level cost hierarchies are expressly not variable with respect to production volume, while unit-level costs are generally expected to fluctuate according to production level. Therefore, only unit-level costs can be considered incremental to volume. However, it is useful to average non-incremental costs with production volume to derive a fully absorbed unit-level cost per product. This is accomplished by dividing each cost hierarchy by the number of units produced. Care must be taken to ensure information users realize that the resultant unit cost is not output variable. A discussion on the application of incremental costs to decision making using cost hierarchies is presented in Chapter 7. Step three is diagrammed below in figure 3.9:



(Figure 3.9)

3.5.4 Step 4: Reconcile costs. Before the information can be presented and utilized, it is necessary to make sure that the ABC model is accurate and complete. Traditional net income, produced through the general ledger, must agree with the net income computed using ABC. This reconciliation adds credibility to the model and confidence to its application. Reconciliation takes place at five points as shown in figure 3.10:

Point-1: The sum of all departmental costs must equal the sum of all general ledger expenses.

Point-2: The sum of all cost pools must equal the sum of all departmental costs.

Point-3: The sum of all the departmental activities must equal the sum of all the cost pools.

Point-4: The sum of all cost hierarchies must equal total activity costs.

Point-5: The unit cost of each hierarchy when multiplied by total units produced should equal the sum of all general ledger costs.

(figure 3.10)

3.5.5 Step 5: Report product cost using full disclosure of cost hierarchy. Fully absorbed unit costs can be extremely misleading to management (Horngren 1972). A unit cost tends to imply unit variability. Utilizing a full unit cost without proper disclosure can prove to be disastrous for decision making (Batty 1978). With traditional systems, management is sometimes presented with a unit cost with the fixed and variable portions identified (Burch 1994). The same presentation format could be used for ABC unit costs. That is, the unit cost could be presented displaying the its cost hierarchy components. In this way, decision making information is maximized. Step five is diagrammed below in figure 3.11:

ABC UNIT COST PRESENTATION		
Unit-level unit cost	XX.00	Incremental
Batch-level unit cost	XX.00	|
Product-level unit cost	XX.00	V
Facility-level unit cost	XX.00	relatively fixed
Fully absorbed unit cost	XXX.00	

(Figure 3.11)

3.6 AN ILLUSTRATIVE EXAMPLE OF BASIC ABC CONSTRUCTION

The following illustration is of a simplified company performing each step of the implementation process. Figure 3.12 reveals Adams Company's partial general ledger for the past year and will be used as the basis for the construction of an ABC model.

Adams Company General ledger
Expenses only
Year ended 19XX

Administration		Sales:	
Executive salaries	£ 200.00	Salesperson salaries	£ 175.00
Interest expense	147.00	Sales commissions	49.00
Real estate taxes	50.00	Travel	33.00
Payroll taxes	25.00	Auto expense	19.00
Depreciation exp-bldg.	75.00	Advertising expense	70.00
Secretarial salaries	106.00	Promotional expense	13.00
Travel expense	35.00	Customer service salaries	89.00
Telephone expense	111.00		
Utilities expense	17.00	Production:	
Insurance expense-bldg.	40.00	Direct wages	43.00
Data processing expense	112.00	Support salaries	26.00
		Supplies expense	15.00
Accounting:		Trucking expense	19.00
Accounting salaries	147.00		
Supplies expense	55.00	Cost of goods sold:	
Training expense	28.00	Purchases	248.00
Travel expense	10.00	Inventory adjustment	41.00
Office support wages	98.00	Transportation-In	71.00

		Total expenses	£ 2,167.00

(Figure 3.12)

3.7 STAGE 1: TRANSFORMING THE LEDGER COSTS INTO ACTIVITY COSTS

Stage one of the implementation process requires a fair reflection of resource consumption by each activity centre (department). This requires establishment of cause-and-effect links between resource and activity centres. The five steps described previously are now performed using the financial figures of Adams Company (above).

3.7.1 Step 1: Group expenses by activity centres. Adams Company's general ledger is already organized by functional area. Thus, the activity centres have already been identified as administration, accounting, sales, and production. However, the expenses listed under each heading do not yet fairly represent the cost associated with carrying out the objectives of each department. For example, the telephone expense account has accumulated completely in the administration department. All the other departments utilize the telephone to perform their function. Therefore, the telephone expense (resource) must be traced to each department. The cost driver used to trace the expense to each department must reasonably reflect the rate of resource consumption. Other administrative expenses which may need to be traced to, or allocated among, other departments include payroll taxes, real estate taxes, building depreciation, insurance expense, interest expense, utilities, and data processing expense. However, not all the expenses will be allocated to every department. For example, the production department does not have a computer terminal and therefore does not consume data processing resources. Figure 3.13 shows how Adams Company decided to allocate shared common expenses among departments:

Shared expenses	Allocation method	ADM	ACC	SAL	PRO
Telephone	Detailed telephone log	28%	10%	60%	2%
Payroll taxes	Total wage value per department	36%	29%	27%	8%
Real estate taxes	Floor space consumed by department	12%	8%	13%	67%
Building deprec.	Floor space consumed by department	12%	8%	13%	67%
Insurance-building	Floor space consumed by department	12%	8%	13%	67%
Interest	Arbitrary allocation by budget value	42%	16%	21%	21%
Data processing	CPU time consumed by each department	24%	60%	16%	0%
Utilities	Floor space consumed by department	12%	8%	13%	67%

(Figure 3.13)

Figure 3.14 below shows the activity centres after allocation of the above shared expenses.

ACTIVITY CENTRES WITH ALLOCATED SHARED EXPENSES

Administration		Sales:	
Executive salaries	£ 200.00	Salesperson salaries	£ 175.00
Interest expense (%)	61.74	Sales commissions	49.00
Real estate taxes (%)	6.00	Travel	33.00
Payroll taxes (%)	9.00	Auto expense	19.00
Depreciation exp-bldg. (%)	9.00	Advertising expense	70.00
Secretarial salaries	106.00	Promotional expense	13.00
Travel expense	35.00	Customer service salaries	89.00
Telephone expense (%)	31.08	Telephone expense (%)	66.60
Utilities expense (%)	2.04	Payroll taxes (%)	6.75
Insurance-bldg. (%)	4.80	Real estate taxes (%)	6.50
Data processing exp (%)	26.88	Depreciation-bldg (%)	9.75
	------	Insurance-bldg (%)	5.20
Total	491.54	Utilities expense (%)	2.21
		Interest expense (%)	30.87
Accounting:		Data processing exp (%)	17.92
Accounting salaries	147.00		------
Supplies expense	55.00	Total	593.80
Utilities expense (%)	1.36		
Training expense	28.00	Production:	
Travel expense	10.00	Support salaries	26.00
Office support wages	98.00	Supplies expense	15.00
Telephone expense (%)	11.10	Trucking expense	19.00
Payroll taxes (%)	7.25	Purchases	248.00
Real estate taxes (%)	4.00	Inventory adjustment	41.00
Depreciation-bldg. (%)	6.00	Transportation-In	71.00
Insurance-bldg (%)	3.20	Direct wages	43.00
Interest expense (%)	23.52	Payroll taxes (%)	2.00
Data processing Exp (%)	67.20	Real estate taxes (%)	33.50
	------	Depreciation-bldg (%)	50.25
Total	461.63	Insurance-bldg (%)	26.80
		Interest expense (%)	30.87
		Telephone expense (%)	2.22
		Utilities	11.39

		Total	620.03
		Total expense	2,167.00

KEY: (%) = Allocated expense to department

(Figure 3.14)

Step one is complete once all the general ledger expense items have been reasonably allocated to the activity centres. Total expenses from the general ledger should be equal to the sum of all departmental expenses.

3.7.2 Step 2: Group departmental expenses into cost pools. Cost pools are natural expense categories which have similar behavioural characteristics (Brimson 1991). A cost pool simplifies the process of tracing resources to activities by eliminating the need to trace every single expense category. Consequently, the required number of cost drivers is reduced to the number of cost pools (Beaujon and Singhal 1990). By examining each activity centre's expense categories for differences and similarities, natural expense categories can be identified. For example, Adams Company may group expenses into the five following "natural expense" categories:

1. Material related expenses
2. Labour related expenses
3. Property related expenses
4. Transportation related expenses
5. Miscellaneous cost pool.

Figure 3.15 presents the Adams Company's cost pools calculated by department (cost centre):

Cost pool	Administrative	Accounting	Sales	Production
Labour	Executive salaries Payroll taxes Secretarial sal Total £ 315.00	Accounting salaries Training expense Office support wages Payroll taxes Total £ 280.25	Sales salaries Sales commissions Payroll taxes Customer service sal Total £ 319.75	Direct wages Support salaries Payroll taxes Total £ 71.00
Material	Total £ 00.00	Supplies Expense Total £ 55.00	Total £ 00.00	Purchases Inventory adjustment Supplies expense Total £ 304.00
Property	Real estate taxes Depreciation exp Utilities Insurance Total £ 21.84	Real estate taxes Depreciation exp Utilities Insurance Total £ 14.56	Real estate taxes Depreciation exp Utilities Insurance Total £ 23.66	Real estate taxes Depreciation exp Utilities Insurance Total £ 121.94
Transport	Travel expense Total £ 35.00	Travel expense Total £ 10.00	Travel expense Auto expense Total £ 52.00	Trucking expense Transportation-In Total £ 90.00
Misc	Interest expense Telephone expense Data processing ex Total £ 119.70	Interest expense Telephone expense Data processing exp Total £ 101.82	Interest expense Telephone expense Data processing exp Advertising expense Promotional expense Total £ 198.39	Interest expense Telephone expense Total £ 33.09
Grand	Total £ 491.54	Total £ 461.63	Total £ 593.80	Total £ 620.03

(Figure 3.15)

3.7.3 Step 3 & 4: Determine departmental activities and code them with cost hierarchy levels. Each functional area of the company performs a number of different activities to accomplish its functional objective. The functional objective of the accounting department may be to track, analyze, and report the financial condition of the company. The activities that the accounting department performs are thus intended to serve this aim.

An activity should be a significant identifiable aspect of the functional area (Turney 1992). Once the activities have been identified, they must be classified according to one of Cooper's (1990a) four cost hierarchies in order to determine the appropriate cost driver.

Below in figure 3.16 are the activities Adams Company has identified for each department along with their cost hierarchy classification:

Department	#	Activity	Level
Administration:	1	planning and evaluating product strategy	PROD
	2	maintaining human resources	FAC
	3	maintaining customer and supplier relations	PROD
	4	miscellaneous problem solving	FAC
Accounting:	5	preparing budgets	FAC
	6	maintaining the general ledger	FAC
	7	preparing reports	FAC
	8	complying with regulatory requirements	FAC
Sales:	9	preparing sales forecasts	FAC
	10	making sales calls	FAC
	11	preparing call reports	FAC
	12	servicing customer concerns	PROD
Production:	13	purchasing raw materials	PROD
	14	moving raw materials in and out of processing machine	UNIT
	15	inspecting machine out	UNIT
	16	resetting machine for different product lines	BATCH
	17	maintaining building	FAC

(Figure 3.16)

3.7.4 Step 5: Trace departmental cost pools to activities. Each cost pool is intended to possess a common behavioural characteristic. This allows for a limited number of cost drivers required to trace or allocate resources to activities (Brimson 1991). It is necessary to choose cost drivers which reflect the best possible cause-and-effect link between resource and activity. If more than one cost driver is needed to trace a single cost pool, it is possible that the cost pool is too broad and needs to be decomposed into more than one activity.

For each cost pool a homogeneous single cost driver is selected. After this, the cost driver information must be collected for each activity centre. The cost drivers selected should reflect the preassigned cost hierarchy classification designation of unit, batch, product, or facility. The cost drivers selected for Adams Company are presented below in figures 3.17 followed by figures 3.18 through 3.21, which show the driver transaction information and cost allocation for each activity, that completes stage one of the implementation process:

COST POOL	COST DRIVER
LABOUR	PROPORTIONATE NUMBER OF MAN HOURS
MATERIAL	PROPORTIONATE NUMBER OF UNITS
PROPERTY	PROPORTIONATE SQUARE FOOTAGE
TRANSPORT	PROPORTIONATE NUMBER OF MILES
MISC	PROPORTIONATE NUMBER OF MAN HOURS

(Figure 3.17)

ADMINISTRATION		DRIVER PERCENTAGES				ACTIVITY COSTS			
COST POOL	COST	ACT1	ACT2	ACT3	ACT4	ACT 1	ACT 2	ACT 3	ACT 4
LABOUR	£315.00	15%	40%	10%	35%	£ 47.25	£126.00	£ 31.50	£110.25
MATERIAL	00.00	NA	NA	NA	NA				
PROPERTY	21.84	25%	25%	40%	10%	5.46	5.46	8.74	2.18
TRANSPORT	35.00			90%	10%			31.50	3.50
MISC	119.70	10%	5%	10%	75%	11.90	5.98	11.90	89.92
TOTAL	£491.54					£ 64.61	£137.44	£ 83.64	£205.85

(Figure 3.18)

ACCOUNTING		DRIVER PERCENTAGES				ACTIVITY COSTS			
COST POOL	COST	ACT5	ACT6	ACT7	ACT8	ACT 5	ACT 6	ACT 7	ACT 8
LABOUR	£280.25	10%	40%	25%	25%	£ 28.02	£112.10	£ 70.07	£ 70.06
MATERIAL	55.00	100%				£ 55.00			
PROPERTY	14.56	20%	10%	10%	70%	£ 2.91	£ 1.45	£ 1.45	£ 8.75
TRANSPORT	10.00				100%				£ 10.00
MISC	101.82	15%	15%	15%	55%	£ 15.27	£ 15.27	£ 15.27	£ 56.01
TOTAL	£461.63					£101.20	£128.82	£ 86.79	£144.82

(Figure 3.19)

SALES		DRIVER PERCENTAGES				ACTIVITY COSTS			
COST POOL	COST	ACT9	ACT10	ACT11	ACT12	ACT 9	ACT 10	ACT 11	ACT 12
LABOUR	£319.75	15%	25%	25%	35%	£ 47.96	£ 79.94	£ 79.94	£111.91
MATERIAL	00.00	NA	NA	NA	NA				
PROPERTY	23.66	90%			10%	£ 21.29			£ 2.37
TRANSPORT	52.00		85%		15%	£ 44.20			£ 7.80
MISC	198.39	20%	20%	20%	40%	£ 39.76	£ 39.76	£ 39.76	£ 79.11
TOTAL	£593.80					£153.21	£119.70	£119.70	£201.19

(Figure 3.20)

PRODUCTION		DRIVER PERCENTAGES					ACTIVITY COSTS				
COST POOL	COST	ACT13	ACT14	ACT15	ACT16	ACT17	ACT 13	ACT 14	ACT 15	ACT 16	ACT 17
LABOUR	£ 71.00	15%	20%	20%	35%	10%	£ 10.65	£ 14.20	£ 14.20	£ 14.20	£ 17.75
MATERIAL	304.00	40%	20%	40%			£121.60	£ 60.80	£121.60		
PROPERTY	121.94	30%	30%	10%	15%	15%	£ 36.58	£ 36.58	£ 12.19	£ 18.29	£ 18.30
TRANSPORT	90.00	90%				10%	£ 81.00				£ 9.00
MISC	33.09	20%	10%	10%	10%	50%	£ 6.62	£ 3.31	£ 3.31	£ 3.31	£ 16.54
TOTAL	£620.03						£256.45	£114.89	£151.30	£ 35.80	£ 61.59

(Figure 3.21)

3.8 STAGE 2: TRANSFORMING ACTIVITY COSTS INTO PRODUCT COSTS

The objective of processing cost data into activities is to finally get the cost down to the cost object. Some activities will go directly down to the product, while others are re-allocated to activities within other departments, and then subsequently traced down to the cost object. As described previously, this stage requires five steps.

3.8.1 Step 1: Trace activity costs to cost objects. Tracing activity costs to products requires seven tasks to be completed as follows:

Task 1: Organize cost centres into a cost centre hierarchy.
Task 2: Label each activity as either direct or indirect.
Task 3: Establish activity targets.
Task 4: Determine a method of allocation to link the activities to their respective targets.
Task 5: Drive all direct costs to their activity target.
Task 6: Allocate all indirect activity costs among resident cost centre activities.
Task 7: Trace adjusted activity costs to the final cost object targets.

Task 1: Organize cost centres into hierarchies. Establishing a cost centre hierarchy prevents a never-ending circle of allocation and re-allocation. A cost centre hierarchy is an ordering of most-support-oriented activities to least support-oriented activities. To prevent endless re-allocation between departments, the direction of allocation should only flow from the top of the cost centre hierarchy to the bottom. The most support-oriented departments would be exporting activity costs to other departments, while the least-support-oriented departments would be importing activity cost from exporting departments. For example, the Administration and Accounting departments for Adams Company would be high up on the cost centre hierarchy and thus would most likely be exporting activity costs to Sales and Production departments. Figure 3.22 shows the cost centre hierarchy established for Adams Company:

COST CENTRE HIERARCHY

	MOST SUPPORT
Administration	
Accounting	
Sales	
Production	
	LEAST SUPPORT

(Figure 3.22)

Task 2: Label activities direct or indirect. The purpose, or the objective, of the activity provides the information necessary to assess the appropriate path for the activity. An activity must be designated as either possessing a direct or indirect path to the cost object. An activity is direct when it directly supports the products or services offered by the company and when it can reasonably be traced to the cost object. Indirect activities support the cost object only indirectly by first supporting other departments of the company. The activities for Adams Company are labelled below in figure 3.23:

DIRECT OR INDIRECT CLASSIFICATION

ACT#	ACTIVITY DESCRIPTION	LABEL
	ADMINISTRATION:	
1.	Planning and evaluating product strategy	Indirect
2.	Maintaining human resources	Indirect
3.	Maintaining customer and supplier relations	direct
4.	Miscellaneous problem solving	Indirect
	ACCOUNTING:	
5.	Preparing budgets	Indirect
6.	Maintaining the general ledger	Indirect
7.	Preparing reports	Indirect
8.	Complying with regulatory requirements	Indirect
	SALES:	
9.	Preparing sales forecasts	Direct
10.	Making sales calls	Direct
11.	Preparing call reports	Direct
12.	Servicing customer concerns	Direct
	PRODUCTION:	
13.	Purchasing raw materials	Direct
14.	Moving raw materials in processing machines	Direct
15.	Inspecting machines	Direct
16.	Resetting machines for different products	Direct
17.	Maintaining building	Indirect

(Figure 3.23)

Task 3: Establish activity targets. Once the activities have been labelled as direct or indirect they must be matched to specific targets. Activity targets are the products or departments which the activity is intended to support. Each activity must have at least one activity target. For example, if an activity is labelled as **indirect**, the specific departments which the activity supports must be identified. Similarly, if an activity is labelled as **direct** then specific products (cost objects) must be identified. In other words, direct activities should have cost objects or products as targets, and indirect activities should have departments or cost centres as targets. Some direct activities may be targeted to every product, while other activities may be targeted to only a few. The same is true for indirect activities. Some indirect activities may be targeted for every department, while other activities may be targeted to only a single department. The activity targets established for Adams Company are presented in figure 3.24 below:

ACTIVITY TARGETS		
ACT#	LABEL	TARGETS (products or departments)
1	Indirect	Sales, Production
2	Indirect	Administration, Accounting, Sales, production
3	Direct	Product-A, Product-B
4	Indirect	Administration, Accounting, Sales, Production
5	Indirect	Administration, Accounting, Sales, Production
6	Indirect	Administration, Accounting, Sales, Production
7	Indirect	Administration, Accounting
8	Indirect	Administration
9	Direct	Product-A, Product-B
10	Direct	Product-A, Product-B
11	Direct	Product-A, Product-B
12	Direct	Product-A, Product-B
13	Direct	Product-A, Product-B
14	Direct	Product-B
15	Direct	Product-A, Product-B
16	Direct	Product-A
17	Indirect	Administration, Accounting, Sales, Production

(Figure 3.24)

Task 4: Determine allocation to link activities to targets. Once the activity targets have been identified, a method for linking the activity cost to its target must be established. This link is the cost driver, that is intended to represent the consumption of activities by activity targets. If an activity has a single activity target, no cost driver is needed since 100% of the cost is consumed by that target. Below in figure 3.25 is Adams Company's selected cost drivers linking activities to established targets:

ACTIVITY TARGETS AND COST DRIVER METHODS		
ACT#	TARGETS	COST DRIVER
1	Sales, Production	By number of units produced
2	Administration, Accounting, Sales, production	By head count
3	Product-A, Product-B	By number of customer complaints
4	Administration, Accounting, Sales, Production	By number of hours
5	Administration, Accounting, Sales, Production	By number of GL accounts
6	Administration, Accounting, Sales, Production	By number of GL accounts
7	Administration, Accounting	By number of hours
8	Administration	No allocation method needed
9	Product-A, Product-B	By sale volume
10	Product-A, Product-B	By number of sales calls
11	Product-A, Product-B	By number of call reports
12	Product-A, Product-B	By number of customer complaints
13	Product-A, Product-B	By number of purchase orders
14	Product-B	No allocation method needed
15	Product-A, Product-B	By number of units produced
16	Product-A	No allocation method needed
17	Administration, Accounting, Sales, Production	By square footage

(Figure 3.25)

Task 5: Drive all indirect activity costs to activity targets. Each indirect activity cost must be driven to the target departments using the designated cost driver. This requires a two stage allocation process. First, indirect costs are driven to specific department targets. Second, the imported activity costs are then allocated among resident activities originating within the department (task 6 below). The indirect activities which are to be exported to other departments for Adams Company are presented below in figure 3.26, together with their respective activity costs and allocation percentage:

INDIRECT		ALLOCATION PERCENTAGES				ACTIVITY TARGETS				
ACT#	COST	ADMIN	ACCG	SALES	PROD	ADMIN	ACCG	SALES	PROD	TOTAL
1	£ 64.61			60%	40%			£ 38.76	£ 25.85	£ 64.61
2	£137.44	20%	10%	30%	40%	£ 27.49	£ 13.74	£ 41.23	£ 54.98	£137.44
4	£205.85	10%	10%	60%	20%	£ 20.58	£ 20.58	£123.51	£ 41.18	£205.85
5	£101.20	25%	10%	35%	30%	£ 25.30	£ 10.12	£ 35.42	£ 30.36	£101.20
6	£128.82	15%	25%	30%	30%	£ 19.33	£ 32.20	£ 38.65	£ 38.64	£128.82
7	£ 86.79	70%	30%			£ 60.75	£ 26.04			£ 86.79
8	£144.82	100%				£144.82				£144.82
17	£ 61.59	30%	15%	20%	35%	£ 18.47	£ 9.24	£ 12.31	£ 21.57	£ 61.59
TOTL	£931.12					£316.74	£111.92	£289.88	£212.58	£931.12
ADJUSTED AND ALLOCATED INDIRECT COSTS						£360.01		£329.48	£241.63	£931.12

(Figure 3.26)

Task 6: Allocate imported activity costs among resident cost centre activities. Once indirect activity costs have been allocated to a cost centre, it must be allocated again to distribute the imported costs among the resident activities. An appropriate allocation method must be selected to accomplish this distribution. This could be accomplished in one of two ways. First, the sum of all the activity costs exported to a cost centre could be distributed among the resident activities using a single allocation method. Second, each individual indirect activity could be distributed separately using its own unique allocation method. The problem with the second option is that it is very difficult to establish a logical cause-and-effect link between indirect activities and direct activities. ABC theory would indicate that direct activities consume indirect activities. This consumption pattern is less than obvious and thus often requires some arbitrary allocation method. If individual cost drivers could be established for each imported activity cost then they should be used. Adams Company allocates imported activity costs using a single cost driver. The allocation is based on the proportionate percentage of resident direct activities originating in the target department before the allocation of imported costs. Adjusted activity costs are the result. This information is summarized in figures 3.27 through 3.29 below:

ADMINISTRATION		IMPORTED COSTS	£360.01	
ACT#	UNADJUSTED DIR COSTS	PROP%	AMOUNT ALLOCATED	ADJUSTED DIR COSTS
3	£ 83.64	100%	£ 360.01	£ 443.65

(Figure 3.27)

SALES		IMPORTED COSTS	£329.48	
ACT#	UNADJUSTED DIR COSTS	PROP%	AMOUNT ALLOCATED	ADJUSTED DIR COSTS
9	£ 153.21	25%	£ 82.37	£ 235.58
10	£ 119.70	20%	£ 65.90	£ 185.60
11	£ 119.70	20%	£ 65.90	£ 185.60
12	£ 210.19	35%	£ 115.31	£ 325.50
TOTL	£ 602.80	100%	£ 329.48	£ 932.28

(Figure 3.28)

PRODUCTION		IMPORTED COSTS	£241.63	
ACT#	UNADJUSTED DIR COSTS	PROP%	AMOUNT ALLOCATED	ADJUSTED DIR COSTS
13	£ 256.45	46%	£ 111.15	£ 367.60
14	£ 114.89	21%	£ 50.74	£ 165.63
15	£ 151.30	27%	£ 65.24	£ 216.54
16	£ 35.80	6%	£ 14.50	£ 50.30
TOTL	£ 558.44	100%	£ 241.63	£ 800.07

(Figure 3.29)

Task 7: Trace adjusted direct activity costs to final cost object targets. The final task in step one is to trace adjusted activity costs to the products. Figure 3.30 shows how adjusted direct activity costs are traced to products A and B using the designated cost drivers for Adams Company:

ADJ DIRECT		TARGET PERCENTAGES		ALLOCATED DIRECT COSTS	
ACT#	COST	PRODUCT-A	PRODUCT-B	PRODUCT-A	PRODUCT-B
3	£ 443.65	10%	90%	£ 44.38	£ 399.27
9	£ 235.58	20%	80%	£ 47.12	£ 188.46
10	£ 185.60	15%	85%	£ 27.84	£ 157.76
11	£ 185.60	25%	75%	£ 46.40	£ 139.20
12	£ 325.50	60%	40%	£ 195.36	£ 130.14
13	£ 367.60	35%	65%	£ 128.66	£ 238.94
14	£ 165.63		100%		£ 165.63
15	£ 216.54	25%	75%	£ 54.14	£ 162.40
16	£ 50.30	100%		£ 50.30	
TOTL	£2176.00			£ 594.20	£1581.80

(Figure 3.30)

3.8.2 Step 2: Determine cost hierarchy subtotals. Each product or cost object is composed of activity costs which belong to a designated cost hierarchy classification. The indirect activity costs were consumed by the department targets and therefore need not be reflected in the hierarchical cost structure for product costs. Adams Company's cost hierarchy composition is presented below in figure 3.31:

	PRODUCT A				PRODUCT B			
ACT#	UNIT	BATCH	PROD	FACL	UNIT	BATCH	PROD	FACL
3			£ 44.38				£ 399.27	
9				£ 47.12				£ 188.46
10				£ 27.84				£ 157.76
11				£ 46.40				£ 139.20
12			£ 195.36				£ 130.14	
13			£ 128.66				£ 238.94	
14					£ 165.63			
15	£ 54.14				£ 162.40			
16		£ 50.30						
TOTL	£ 54.14	£ 50.30	£ 368.40	£ 121.36	£ 328.03		£ 768.35	£ 485.42

(Figure 3.31)

3.8.3 Step 3: Unitize all cost hierarchy levels. Although it is not necessary to unitize all the components of product cost, it is useful to possess fully absorbed unit costs for some decisions. To accomplish this, each hierarchy cost level must be divided by the number of units produced. However, it is very important to retain the hierarchy classification label given to each cost component. The unit costs for products A and B are presented below in figure 3.32:

```
               UNIT COST CALCULATIONS

 PRODUCT A
   UNIT: (£54.14 / 200 units) =                £  .27
   BATCH: (£50.30 / 200 units) =               £  .25
   PRODUCT: (£368.40 / 200 units) =            £ 1.84
   FACILITY: (£121.36 / 200 units) =           £  .61
                                               ------
   TOTAL UNIT COST                                     £ 2.97


 PRODUCT B
   UNIT: (£328.03 / 110 units) =               £ 2.98
   BATCH: (no batch level costs) =             £    0
   PRODUCT: (£768.35 / 110 units) =            £ 6.98
   FACILITY: (£485.42 / 110 units) =           £ 4.41
                                               ------
   TOTAL UNIT COST                                     £14.37

Product A = 200 units produced for the year
Product B = 110 units produced for the year
```

(Figure 3.32)

3.8.4 Step 4: Reconcile costs. The extensive cost data manipulation necessary to transform general ledger information into activity-related product cost information leaves many places for errors and omissions. Even with sophisticated computer programs, many of the omissions may not be noticed. This is why it is necessary to reconcile the calculated results in the ABC model with the ledger system. There are five points of reconciliation as described previously. The reconciliation points for Adams Company are presented in figure 3.33 below:

Point 1: Sum of cost centres should equal total GL expenses after first allocation round.

Administration	£491.54	= £2176 Total GL expenses
Accounting	£461.63	
Sales	£593.80	
Production	£620.03	

Point 2: Sum of cost pools should equal sum of cost centres.

Labour	£986.00	= 2176	Administration
Material	£359.00		Accounting
Property	£182.00		Sales
Transport	£187.00		Production
Misc	£453.00		

Point 3: Sum of all activities cost must equal sum of cost pools.

Act 1	£ 64.61	= £2176	Labour
Act 2	£137.44		Material
Act 3	£ 83.64		Property
Act 4	£205.85		Transport
Act 5	£101.20		Misc
Act 6	£128.82		
Act 7	£ 86.79		
Act 8	£144.82		
Act 9	£153.21		
Act10	£119.70		
Act11	£119.70		
Act12	£201.19		
Act13	£256.45		
Act14	£114.89		
Act15	£151.30		
Act16	£ 35.80		
Act17	£ 61.59		

Point 4: The sum of the cost hierarchies must equal the sum of all activity costs.

Unit-level costs	£ 382.17	= £2176
Batch-level costs	£ 50.30	
Product-level costs	£1136.75	
Facility-level costs	£ 606.78	

Point 5: Unit costs multiplied by units produced should equal total expenses.

Product A: (£ 2.97 x 200) = £ 594.00	= 2176 (aprox.)
Product B: (£14.37 x 110) = £1580.70	

(Figure 3.33)

3.8.5 Step 5: Report product costs using full disclosure of cost hierarchy composition. Although unit costs can be very useful, they can also be very misleading. Just as with traditional full absorption costing, ABC unit costs are just as prone to misinterpretation. This is why it is important to report unit costs with full disclosure of the cost components, utilizing the cost hierarchy suggested by Cooper (1990a). Although ABC considers all costs to be variable in the long-term, only unit-level costs are considered to be variable with respect to production volume.

3.9 CONCLUSION

The computational illustration of the implementation process requires many layers of allocation. Some arbitrariness is therefore present in ABC models. This analysis shows evidence of the potential extent of this problem. For example, many of the facility related resources used in the Adams Company example required arbitrary allocation to force them through activities. Much of the problems of implementation stem from the fact that the ledger system and the ABC system do not link very easily. As explained earlier, ledger systems measure the rate of resource supply while ABC systems measure the rate of resource demand. Linking these two systems requires many layers of complex allocation and calculation. Although computer programs (such as the one used in this case study) do most of the calculations automatically, many of the steps and procedures require the implementation team to work out the correct progression path for themselves. Moreover, it is important to know how these calculations are performed, permitting management to adapt an "off the shelf" software package to their unique organizational environment.

The literature glosses over many of the technical problems and limitations which are exposed by a participant observation study. This descriptive analysis forms one of the foundations for Chapter 9, which assesses the benefits and limitations of ABC, and for developing technical solutions to problems found in the case study outlined in Chapter 12.

In the following chapter some alternative approaches to implementation are presented. In addition, consideration is given to planning issues which support the computational structure illustrated here.

CHAPTER FOUR

IMPLEMENTATION PROCESS

4.1 INTRODUCTION

To construct an ABC model requires more than simply making technical alterations to the management accounting system in the organization. Accounting systems are socio-technical in nature, so broader organizational issues of culture, structure, power and commitment must be addressed (Hopwood 1983, 1987, Bariff and Galbraith 1978, Bhimani and Pigott 1992b). People are involved in utilizing technology in collecting, analysing and using information. These issues are best considered in the planning stage of the implementation process for they have the potential to undermine the implementation of ABC (Innes and Mitchell 1990c, Bhimani and Pigott 1992b, Friedman and Lyne 1995).

This chapter raises a number of issues which may be important to the successful development and implementation of an ABC system. Implementing an ABC system successfully requires careful planning, technical skill, and attention to the organizational environment (Glad 1993). A number of features concerning the implementation process have been compiled from the review of the literature, and this author's experience with the case study in this thesis. Developing an implementation plan enhances the chances of successful implementation, increases the designer's knowledge of the current system, contributes to a sense of ownership among the implementation team, and ensures that problems are addressed at an early stage (Hobdy et al. 1994).

Based on the existing case study literature on ABC implementation and this author's experience at Calor Gas (see Chapters 11 through 14), a composite of an implementation process has been developed by the author as a blueprint for implementing future ABC cost systems (Cooper 1990c, Cooper and Kaplan 1992a, Brimson 1991, Turney 1992). The implementation process can be broken down into four phases; identification, preparation, assembly, and review. A model of these phases is presented in figure 4.1 below. The identification phase involves defining the aims and direction of the system. The preparation phase is primarily an evaluation process of the current system and of expectations concerning a future system. The assembly phase is concerned with constructing the ABC system. Finally, in the review phase the results of the system are tested and plans for utilizing the information are established.

PHASES OF IMPLEMENTATION

IDENTIFICATION	PREPARATION	ASSEMBLY	REVIEW
* State objectives * Determine progression path * Describe scope * Obtain commitment	* Design model * Evaluate current organization * Evaluate current cost system * Identify implementation team * Determine training requirements	* Prepare schedule * Evaluate IT system * Determine document needs * Collect activity information * Perform value analysis * Prepare ledger * Identify resource drivers * Determine cost objects * Identify activity driver * load model	* Run model and generate report * Evaluate results * Prepare analysis * Identify possible actions * Prepare system for long-term use

(Figure 4.1)

The details of each phase of the implementation process make up the body of this chapter.

4.2 IDENTIFICATION PHASE

4.2.1 State the objective of the system. Before the system can be designed, it is important to define the mission of the new cost system clearly and concisely (Cooper 1990c). Fisher et al. (1990) suggest that this should be a broad statement encompassing the main motivation for implementation, specific inadequacy of the current system, and also include certain hypotheses about current product mix, complexity, and diversity. Estrin et al. (1994) identify criteria upon which to base the suitability of installing an ABC system. These include the extent of common cost allocation, support diversity, and production complexity. It is argued that the stated purposes of a new costing system should be evaluated against these criteria to test the appropriateness of the system.

4.2.2 Determine implementation paths. How a particular organization progresses through the phases of an ABC implementation project depends upon the internal and external organizational environment, views of accountants and managers, capabilities of organizational members, and motivations and the purposes of the new system (Vercio 1993). Friedman and Lyne (1995) outline the uses and motivations of eleven companies implementing ABC, and demonstrate how these factors impinge on the ABC implementation process. Their results are summarized in figure 4.2 below:

USE CATEGORIES	MOTIVATION CATEGORIES
PRICING	POOR DATA FOR BUDGETS AND COSTING
DECISION MAKING	DEPARTMENTAL SEPARATION FOR COSTING BIDS
FLEXIBLE BUDGETING	CHANGING FINANCIAL CULTURE
TRANSFER PRICING	ADDRESSING NEWLY COMPETITIVE ENVIRONMENT
CAPITAL EXPENDITURE	ASSESSING COST OF QUALITY
COST MANAGEMENT	REDUCING OVERHEAD COSTS
PROCESS IMPROVEMENT	THE NEED TO WIN PROFITABLE BIDS
SUPPLY CHAIN ANALYSIS	ASSESSING PROFITABLE CUSTOMERS
OVERHEAD ANALYSIS	
VALUE ANALYSIS	
PERFORMANCE MEASUREMENT	

(Figure 4.2)

Some companies in their study proceeded in a fairly straight forward step-by-step process from learning about ABC concepts to more advanced ABM analysis. Other companies started off with small pilot projects and moved on to other parts of the company, building on previous successes. Most of the companies experienced some level of interruption. For example, one company aborted the ABC project for several months because of alarmingly poor financial performance. It was necessary in many cases to suspend implementation to focus on more immediate needs of the company. Friedman and Lyne (1995) concluded that implementation was less likely to be interrupted when a company could focus on long-term strategic needs without having to attend to immediate crises. However, Bailey (1991) warns that when long time periods lapsed, or when serious environmental disruptions occur, the risk of project failure increases. Friedman and Lyne (1995) identified five different categories of implementation paths experienced in their case studies as follows:

> **1. By organizational segment.** A localized approach to the implementation process is used to determine the feasibility of continuation of the project and as a means of acquiring the necessary skills to apply to the whole organization. This approach tends to be used by organizations which choose not to use external consultants. An example of this would be to construct an ABC model for a specific department, and evaluate the experience and the potential benefits in order to learn how to implement it company-wide and to build confidence and commitment for the project.

2. By experiment. A sample of cost objects are chosen to determine if ABC would give significantly different results from the current costing system. Gwynne and Ashworth (1993) argue that if an organization produces products which are relatively homogenous in terms of diversity and complexity then implementing ABC may not result in any significant improvement in the accuracy of product costs.

3. By a top-down approach. At first only broad categories of activities are used to limit the cost and complexity of the model. The model is later augmented to contain more detail. This approach is advocated by Norkiewicz (1994) in which simple models are constructed in order to provide a logical framework upon which to build a more sophisticated system. It is argued that the sophistication of the model should correspond to the same level of sophistication an organization has with implementing ABC.

4. By staff involvement. All levels of staff are involved with the development of an ABC system to some extent. Shields and Young (1989) consider this a necessary component to facilitate the incorporation of a new costing method into the company culture. Turney (1993) also endorses this "empowerment" approach in what he refers to as Working Activity-Based Management (WABM).

5. By spread of use. ABC systems are first designed for a limited specific use and then once the benefits are realized, the system is appended to support other applications in the organization. For example, an ABC model might be constructed to derive accurate costs to support product pricing decisions. As the benefits are realized, the model might be modified by incorporating activity attributes to support process improvement or cost reduction schemes. Shields and Young (1989) describe this approach as an "evolutionary strategy" in which innovation is instituted in a "domino pattern" with change being adopted from one unit of the company to the next. They argue that the advantage to this approach is that the whole company does not have to experience "upheaval" simultaneously.

4.2.3 Identify the expected benefits. An understanding of the expected outcomes of the new system is an important part of building management support for the project and for improving the design of the system. Gammell et al. (1994) identify five basic benefits of an ABC system:

1. Improves accuracy of product costs
2. Enhances understanding of overhead cost behaviour
3. Increases access to non-financial performance measures
4. Operationalizes the budgeting process
5. Provides a link between process changes and cost changes

However, Kaplan (1994b) warns that companies should resist constructing an ABC model based on generic benefits outlined in previous cases. Companies implementing ABC systems should identify specific purposes for the system which are unique to the organization. For example, the following questions should be considered; how will the ABC information help prioritize cost reduction efforts; how will it facilitate quoting or make-buy decisions; and how will it guide development of customer and market strategy?

4.2.4 Describe the scope of the project. The scope of the implementation should state clearly which facilities, branches, or divisions will be included; which cost objects will be measured; and which accounting period will constitute the cost of resources provided (Brimson 1991). In addition, Norris (1994) argues that care must be taken with regard to determining the nature of activity information to be used in the system. For example, resources could be budgeted, actual, or projected, and cost drivers could be expressed in terms of average, standard, or capacity.

4.2.5 Obtain management commitment. Argyris and Kaplan (1994) describe this as part of the "Educational and Sponsorship" process in which change-advocates explore and articulate the technical merits of the new system in an attempt to gain senior management support for the project. Indeed, Bhimani and Pigott (1992b) argue that not only does top management need to endorse the implementation of ABC, but an acceptance from middle to lower functional managers is also necessary for successful implementation. Moreover, Stokes and Lawrimores' (1989) research results reveal that it is important that organizational members do not view the system as an accounting system run by accountants, but rather as an information management system used by every manager involved in decision making.

Overcoming resistance to change is necessary if the project is to be accepted by the company (Scapens and Roberts 1993). Argyris and Kaplan (1994) suggests that the Education and Sponsorship process is not sufficient for new costing systems to be actually used to influence decision making. A second process is needed to create "internal commitment". In contrast to external commitment, which exists when individuals act according to rules set by others, "internal commitment" exists when individuals attribute their effort to personally derived objectives. Internal commitment is needed to overcome resistance to change and to combat the defensive routines that organizational members engage in to protect themselves from the perceived threat of the change (Argyris 1990a, 1990b).

Innes and Mitchell (1990a) categorize three factors underlying the management accounting of change process as "motivators", "catalysts", and "facilitators". Motivators for changing a costing system are fairly enduring influences existing for some time before the change begins. These influences may involve competitive market, organizational structure, product cost structure, or production technology. Poor financial performance, loss of market share, and the launching of new products are the catalysts for changing the costing system. Finally, the impact of these factors must be facilitated through the availability of accounting staff resources, computing resources, and the level authority and credibility of the accountants. The motivators and catalysts described by Innes and Mitchell (1990a) provide some insight as to why a company might consider the implementation of an ABC system and to the resources necessary to facilitate the change from an existing costing system.

Turney (1992) identified a number of typical negative statements which are often made by organizational members confronting the possibility of implementing an ABC system:

> "ABC is too difficult to understand"
> "Improving the existing system will do the job"
> "More accurate costs are not needed"
> "Cost systems play a limited role in process improvement"
>
> (Turney 1992)

Generating interest and overcoming the objections of management must be augmented by a strong and continual commitment to the ABC project (Fisher et al. 1990). Commitment can be obtained by first demonstrating that the company is a good candidate for the application of ABC, and second by illustrating that the current cost system is failing to serve management (Sharman 1991). Cooper (1989b) argues that the diversity and complexity of products increases the value an ABC system could contribute to a company. As the number of product and product lines increases, the higher becomes the risk that conventional systems, which are based on single level unit cost, will distort product costs and overhead allocation values.

4.3 PREPARATION PHASE

4.3.1 Design the model. Designing the ABC model is a critical step in the implementation process. The system should provide the right level of detail and meet the system's objectives at a minimum cost. Cooper (1990c) describes a structured approach to designing an ABC model by identifying six fundamental questions to be answered. These are as follows:

<u>Question 1: Will the ABC system be a stand alone system, or integrated with existing systems?</u>

If the system is incorporated into the existing system design, a lengthy approval process is normally required. In contrast, stand alone systems can be implemented relatively quickly and inexpensively because no software needs to be developed and no integration problems need to be addressed. However, there are two problems with using a stand-alone system according to Norkiewicz (1994). First, data is redundantly stored and system updates have to be reentered either electronically or manually. Second, data is not shared with other software assets of the company.

<u>Question 2: Will the formal implementation plan be prepared?</u>

A formal plan for implementation improves the organization and management of an ABC project. Management can use the implementation plan to establish initial time and cost standards and monitor the progression of the plan according to these standards. A plan can also decrease the level of waste by thinking about the system and its needs in advance and preparing for expected or potential problems. However, Cooper (1990c) warns that much of what is required to implement an ABC system is unknown at the beginning of the project. Moreover, there is a learning curve which requires some time for experimentation and grasping of concepts. A formal plan should not restrict the implementation team from making necessary changes as it gains experience.

Question 3: Who will retain formal ownership of the new system?

It is important to view the ABC system as a management system rather than an accounting system. To achieve this objective, a multidisciplinary team must be established incorporating all areas of the company from engineering to marketing. According to Shields and Young (1989) for an organization to interpret a new costing tool as a management information system to be used by all functional managers, a cultural alteration is required. This alteration is instituted in two ways. The first way is by endorsing the "empowerment" concept, which is the idea that organizational members are more inclined to personally invest in a change when they take part in its development. The second way is by designing the model to meet the needs of functional managers in addition to those of accountants.

Question 4: How accurate should the information be?

The level of precision of information must be accurate enough to achieve the objectives of the system without incurring costs in excess of expected benefits (Merchant and Shields 1993). Cooper (1990c) suggests that the aim of the system should be to get information which is "approximately correct." ABC has been criticized for its lack of complete accuracy in allocating product costs (Noreen 1987, Pattison and Arendt 1994, Piper and Walley 1990). However, Cooper (1990c) admits that ABC does not produce "absolute" accurate costs, but simply "more accurate" costs than traditional systems.

Question 5: Should the system design report on historical data, or use estimates of the future?

Historical costs are likely to be objective and verifiable but are not likely to capture the full economic reality of the environment. Actual costs could be used for bench-marking purposes, which would support a continuous improvement effort (Turney and Stratton 1992). Budgeted or projected costs are highly influenced by interpretation and are therefore less reliable indicators of cost phenomenon (Brimson and Fraser 1991). Norris (1994) suggests that users of ABC systems are more confident using historical information in the construction of an ABC system, but that they would also consider using estimates for projecting the effects of specific decisions.

Question 6: should the initial design start off simple or complex?

Designing a simple system requires less time and energy and can later be updated to accommodate a more complex structure. However, simple models may leave out important aspects of the organization and thus distort information. Complex systems are difficult to construct without the proper exposure to simpler systems to gain the necessary experience. Complex systems improperly built may be distorting as well. Cummings (1991) suggests that the complexity of the system is relative to the complexity of the organization. Glad (1993) argues that constructing a less complex system initially may help to build support for the system by increasing the speed in which benefits are realized.

4.3.2 Evaluate the current organizational structure. Positions of responsibility, reporting relationships, and power configurations must be understood and documented (Bariff and Galbraith 1978). This is to facilitate communication between departments and establish a responsibility network for controlling the process of implementation. This would include analysing various authority sources of evidence such as organizational hierarchies diagrams, job description summaries, information flow charts, and process maps (Morrow and Hazell 1992).

4.3.3 Evaluate the current cost system. Analysing the current costing system provides clues as to how to construct an effective ABC system (Terence 1993). The reason for implementing a new system is because of some degree of dissatisfaction with the old system. The ABC system can be built in consideration of the problems experienced in the past. For example, if strategic job bidding is a key success factor for the company and the old system did not permit accurate assignment of common costs, the ABC system should be constructed to improve the assignment of common costs allocation to specific bidding jobs. Evaluating the current system can also provide key information necessary for comparing the results of the ABC system. Roth and Borthick (1991) suggest that comparing product costs before and after the implementation of ABC is critical for two reasons. First, to test and validate the reasonableness of the ABC results, and second, to guide management to correct policies and procedures which have been erected to support erroneous cost information.

4.3.4 Identify the implementation team. Turney (1992) suggests that three groups are necessary for implementing ABC; the steering committee, the project team, and the project manager. The steering committee is typically composed of top management who oversee the planning and implementation process to ensure that the system meets the objectives of the company. This committee also serves as a responsibility and communication link between the project manager and the president of the company. The project manager acts as the leader of the project and is thus responsible for the successful completion of the system. Shields and Young (1989) argue that this person should be a "Champion" who can motivate and inspire the team during the implementation process. In addition, the project manager typically has the responsibility of assembling the project team. The project team is normally composed of functional managers from various departments in the company. Their responsibility is to carry out the implementation tasks.

Cooper (1990c) identifies several important criteria for selecting team members. He suggests that members should be intelligent, flexible in their approach to problem solving, and knowledgeable about the operations of the organization. It is interesting to note that knowledge of cost accounting was not considered a criterion for selection, however, Cooper acknowledges that at least one person in the team should have an understanding of the current costing system.

4.3.5 Determine training requirement. Turney (1989) suggests that training is necessary at three levels:

> 1. Management-level. Training is focused on the benefits of ABC and its potential for meeting the objectives of the company. The purpose of training at this level is to build confidence and gain support for the project.
>
> 2. Implementation-level. Training is designed to give technical skills to those constructing the model. Training at this level would include how to collect and identify activities, cost drivers and cost objects. It would also involve training on ABC computer software packages such as Easy ABC (ABC Technologies Inc.) and ABC Power (Armstrong Laing Systems Ltd.)
>
> 3. User-level. Training is focused on extracting relevant information from the model and utilizing it in the decision making process.

Even if outside consultants are used to implement the system, maintaining and updating the system and exploiting its benefits are dependent upon users understanding the system's components, attributes, and structure. Argyris and Kaplan (1994) identify a link between training for and commitment to the project. Their research asserts that education reduces barriers to change, which leads to increased personal investment in the project's success.

A training plan should be developed to initiate the project, and for continuous training throughout the project's life. The implementation teams need to understand and use ABC language to communicate and explore ideas. ABC design skills, interviewing skills, and software operation skills must be developed. In addition, general information about the current cost system must be understood by non-accounting members. Also, general information which may have been restricted in the past may need to be made available to the team. Sharman (1991) suggests that a library consisting of books, articles, videos, and software manuals be used to support a "continuous education process" both during and after implementation.

4.4 ASSEMBLY PHASE

4.4.1 Prepare the project schedule. There is no typical time frame for completion of the implementation process. Case studies have revealed that it could last anywhere from five months to several years (Cooper and Kaplan 1992a). Because of the possible length of time of the process, effective time and project management becomes crucial to the implementation's success. Adhering to time targets supports the change process, encourages discipline, and reinforces the importance of keeping on schedule (Amigioni 1978). Norkiewicz (1994) suggests that "Gantt charts" are a helpful tool for planning complex long-term projects. According to Cooper and Kaplan (1991b), many companies can benefit from the use of computer software packages designed specifically for long-term project management.

4.4.2 Evaluate information system requirements. Implementing ABC involves the manipulation of a considerable amount of information and thus is inevitably linked to computer information systems. Primary hardware, peripheral equipment, and software are necessary components of an ABC system. The existing computer environment must be assessed in terms of hardware capability, software capture of cost driver information, import/export capabilities, and adaptability (Bentley 1993). As mentioned earlier, the ABC model could be constructed on a stand-alone personal computer (PC) basis, or written within a mainframe or mini computer environment. If a PC is used, data transferability between existing hardware and the new system must be considered.

Most companies implementing ABC have chosen to use a stand-alone system because it is simple to install and there are many software applications already written to suit the needs of the system (Armatage 1993). However, even if a stand-alone system is chosen, some integration with current systems may still be necessary. For example, the general ledger contains cost information which must be transported to the ABC system. Unfortunately, it is likely that the data structures of each system will not match and the structures will have to be reconciled or transported manually (Ask and Ax 1992). Manual input may be the easiest and simplest option if the number of expense accounts is small. If, on the other hand, there are thousands of accounts, entering the information by hand may not be the most practical method of integration. An electronic data link can be established which can electronically down-load general ledger expenses information into the new format within the ABC system. This would save time, but may be costly to establish.

According to Connolly and Ashworth (1994) there are basically three PC-based software approaches to implementing ABC. These are spreadsheet, decision support packages and specialized ABC software.

> 1. Spreadsheet. Spreadsheets are inexpensive, flexible and widely used for many business applications. This reduces the cost of training and implementing the system. It is best suited for short-term projects which require little updating in the future. However, Bidgoli (1989) argues that using spreadsheet for an ongoing system which processes large quantities of data will eventually become more costly. Data updates and maintenance will require more effort and time as the system grows. Moreover, spreadsheet will not be able to accommodate variable capacity, security, and data integrity problems which are likely to occur in the future.
>
> 2. Decision support packages. Decision support packages such as PC-Express and KPS are powerful tools for constructing electronic solutions for business decisions. These packages are able to accommodate large volumes of data, and are flexible enough to model many unique business environments. They are widely used and generally possess sophisticated reporting capabilities. However, decision support packages are complex systems which require extensive knowledge to operate (Holsapple and Whinston 1987). When using the system within a shared environment, useability will be hindered without continuous training sessions.
>
> 3. Specialized ABC software. In response to the limitations of spreadsheet and decision support packages, specialized ABC software has been developed to address the growing interest in ABC systems. These packages are generally equipped to accommodate large volumes of data, and are designed to facilitate the data interchange between two data structures (Holsapple and Whinston 1987). Some come ready to validate and check the logical flow of the ABC model. In addition, the most advanced packages are able to integrate with popular reporting tools such

as Lotus and Excel (Carter et al. 1986). The two largest producers of specialized ABC packages are Armstrong Laing Systems Ltd., and ABC Technologies Inc..

Connolly and Ashworth (1994) identify seven key issues which should be considered with respect to the electronic information processing aspect of implementing ABC systems.

1. Scope of the system. The range of application and use of the ABC information must be determined. The level of detail and the frequency of update impact the solution.

2. Users and priorities. The users of the system must be identified to address security issues. Who will be allowed access to update and read the data?

3. Timing and timescales. The speed at which the system is intended to be updated impacts both hardware and software issues. Also, other programs and projects which may be currently utilizing existing or anticipated computer resources may create an obstacle for ABC implementation.

4. Data availability. Data from existing systems must be made available for the ABC model. It must be processeable and reformattable to new data structures consistent with the new system's configurations.

5. Flexibility and responsiveness. The computer system must be constructed in such a way to accommodate changes in volume, organization, processing, and other business fluctuations.

6. Cost and benefits. The system requirements and benefits must be weighted against the cost of the hardware, software, and training investments necessary to implement it.

7. Skills. The current and potential human resource capacity must be evaluated. There must be adequately skilled personnel in place to implement the system as well as maintain it in the future.

4.4.3 Determine documentation requirements. The Implementation of an ABC system is equally concerned with introducing a new system as it is with integrating with the old system. As Bhimani and Pigott (1992b) assert, a successful implementation of an ABC system is highly dependent upon the existing organizational environment. There are many sources of information about the nature of the existing organization that ought to be utilized in the implementation process. Turney (1988) suggests that an inventory of documentation sources be collected to ensure that the system is integrated properly with the company's culture, structure, and operational environment. A list of documents necessary for implementation presented below was compiled from a review of various case studies found in the ABC literature, and from experience with the case study being researched by this author (Cooper 1986, Innes and Mitchell 1990c, 1991b, Cooper and Kaplan 1992a, Cobb et al. 1992). It is not intended to be an exhaustive list.

1. Cost ledger reports
2. Organization charts
3. Budget reports
4. System flow diagrams
5. Functional boundary information
6. Responsibility centre information
7. Payroll reports
8. Time cards
9. Head-count listings
10. Existing cost analysis reports
11. Labour contracts
12. Computer specifications
13. Quality reports
14. Procedural manuals
15. Complaint logs
16. Profit and loss statements
17. Building lay-out or plat survey
18. Product specifications
19. Market segment reports
20. Transaction coding reports

4.4.4 Collect activity information. The ABC plan should be specific about how activities will be determined and collected. Data collection strategies include observation, questionnaires, interviews, documentation analysis, and story boards (Turney 1993). For example, the organization must decide by whom, and by what means, will interviews be conducted. Will each member of the team be assigned a segment of the company, or will one interview "expert" be designated? In some companies, pre-interview questionnaires and post-interview questionnaires were used to augment the actual interview (Cooper and Kaplan 1992a). Turney (1993) suggests that "story-boards" should be used to gather activities. Storyboards are visual aids which allow discussion to take place among a number of organizational members. According to Sharman (1991), some activities identified may have to be reformulated, others may have to be decomposed into several activities, and still others may have to be aggregated to form a broader concept of work. Ostrenga (1990) suggests the use of "activity dictionaries" to organize and facilitate the collecting and utilization of activities. Finally, Johnson (1990) warns that activity formulation must be analyzed in terms of cost/benefit. Each activity has a certain level of cost associated with collecting it. The benefit of incorporating the activity in the ABC model should outweigh the cost of collecting it.

4.4.5 Perform value added analysis. Before activities can be coded for "value" or "non-value-added", a clear and concise definition must be formulated. The Computer Aided Manufacturing-International (CAM-I) project (1990) suggest that the definition of a value added activity is an activity which satisfies customer or organizational needs.

> "Value-added reflects a belief that the activity cannot be eliminated without reducing the quantity or quality of output required by the customer or the organization"
>
> (CAM-I 1990)

Turney (1989) describes "non-value-added" as an activity which does not contribute to customer value. The ABC Technologies Inc. 1994 manual defined "value added" as:

> "If the activity appeared as an item on a customer invoice, the customer would not object to paying for it."
>
> (ABC Technologies 1994)

"Non-value-added" activities would include validating, checking, correcting, and inspecting an output produced. For example, reworking defective products might be considered a "non-value-added" activity. The assumption here is that the product should be produced properly the first time without having to check or inspect it later. Whatever the definition of "value" and "non-value-added" used, it should serve the purpose of the costing system, and the mission of the company (Walker 1991).

4.4.6 Prepare the general ledger. The general ledger serves as <u>input</u> for an ABC system. Unfortunately, expenses categories are not created with activities in mind. The current condition of the ledger is unlikely to be ready for these to be traced to activities (Burch

1994). For example, some costs may have to be reallocated, split, or aggregated to accommodate the tracing process. Also, some adjustments may have to be made to depreciation expense and other allocations which are primarily suited for financial reporting purposes.

4.4.7 Identify and capture resource drivers. Resource drivers trace or allocate costs from the general ledger to the activities. There are a number of factors to identifying resource drivers. Cooper (1989a) suggests three factors to consider when selecting cost drivers:

1. The ease of obtaining the data.
2. The correlation of the consumption of the resource to the cost driver.
3. The behaviour induced by the driver.

Banker and Johnson (1988) emphasize the importance of the existence of a cause-and-effect relationship between resources and activities. As discussed earlier, Brimson (1991) suggests grouping general expenses into "natural expense" categories, and using a single resource driver to allocate the cost pool to the activities. For example, property related expenses (e.g. building depreciation, property taxes, rent, heating, and electrical expenses) could be traced to the activities by the proportionate share of physical space consumed.

4.4.8 Determine cost objects. The cost objects are the products produced and/or the customers and markets served. Turney (1992) defines cost object as:

"The reason for performing an activity"

The ABC literature glosses over the process of identifying cost objects. The research literature on this subject seems to assume that this is an elementary process requiring little development. However, this author has discovered that identifying cost objects in practice can be more problematic then the literature recognizes. As will be discussed later in Chapter 12 in Part 2 of this thesis, identifying and classifying cost objects requires a process negotiation among functional managers and may involve the construction of a "parent/child" hierarchy.

4.4.9 Identify and capture activity drivers. Activity drivers are identified in the same way as resource cost drivers, except that activity cost drivers are used to link activities to cost objects (Babad and Balachandran 1993). The activity driver is used to approximate the amount of cost consumed by each cost object or product (MacArthur 1992, Dopuch 1993). Cokins et al. (1993) identify a pragmatic approach to activity driver formulation. Their argument is that it may not be possible to find a practical method of tracing activity costs to products. In this case, a surrogate driver may be used to approximate the cause-and-effect relationship. For example, it may not be practical to collect the number of hours the purchasing activity is devoted to specific products. Instead, a surrogate driver, such as the number of parts required to manufacture a product, may be used to approximate the level of activity cost consumption.

4.4.10 Load the model. Once all the necessary information has been collected, it must be loaded into a computer program. Connolly and Ashworth (1994) identify three different forms of loading the ABC model.

1. Initial loading. General ledger expense categories, cost drivers, activities, and cost objects are loaded to construct the first model.

2. Maintenance loading. The model is updated for changes in expense levels and in the number of cost driver transactions.

3. Model adaptations. As the organization makes changes to processes and activities, the model is updated to reflect these changes.

Although many companies use electronic tools to load and update the model, it is likely that all of the necessary information cannot be updated in this manner. For example, electronic transfer tools are suitable for updating expense level fluctuations and changes in cost driver transaction. However, changes in activity descriptions and qualitative attributes, such as "value" and "non-value-added", are dependent upon managerial judgement and therefore manual update. In addition, loading the model requires the implementation team to consider who will be loading it, how, and when the information contained in the system will be updated.

4.5 REVIEW PHASE

4.5.1 Run and generate reports. Before any reports can be generated, the team must determine the structure and content of the report. The reports should contain the necessary information to address the key business decisions identified at the start of the process. For example, if product costs comparisons are desired, the report should contain the cost of each cost object identified. Fisher et al. (1990) suggest that a sketch of the desired reports should be prepared at an early stage of the implementation process to serve as a guide to designing the model. In addition, it must be determined who will receive which reports and when. Also, consideration should be given to utilizing specialized report software, such as Lotus and Excel, which can be electronically linked to the ABC model.

4.5.2 Evaluate initial results. The first run of the ABC model is likely to contain some errors and lack completeness. Brimson (1991) suggests that reasonableness tests be applied to information generated from the ABC system. This is accomplished by using the current system's cost information as a guide, and then employing managerial judgement to differences. Cooper (1989b) identifies a "rule of thumb" criterion to provide some target of accuracy and reasonableness of the results. For example, if one product is perceived to be twice as complex requiring twice the effort of another product, one would expect that activity costs traced to the first product should be twice the amount of the second product. Current cost system product margins should also be used to compare with ABC product costs. Standards should be established for assessing the validity of the information, and procedures should be formulated for correcting and adjusting the activity information. Finally, a reconciliation of costs and activities should be conducted to ensure that all activities have been included, driven in an appropriate manner, and that no costs have been excluded.

4.5.3 Prepare analysis of results. Once the team determines that the ABC results are complete, valid, and accurate, the results must be analyzed in terms of their implications. According to Norris (1994), basic questions should be asked about the information results generated by the system. These are:

What has the ABC information revealed?
What can be learned about process and patterns?
Which product profit margins have changed?
What decisions could be made from this information?

4.5.4 Identify possible actions to be taken. The analyzed information must be acted upon if the ABC system is to be effective (Turney 1989). Friedman and Lyne (1995) assert that the ultimate success of any information system is its influence on behaviour. Norkiewicz (1994) argues that formal procedures should be established for implementing changes based upon the results. Estimated changes should be matched with the appropriate authority levels in the company to ensure that the information is distributed and communicated to the appropriate personnel.

4.5.5 Plan for long-term use. Although implementing ABC is often referred to as a "project", which implies a temporary nature, the system should be designed and implemented to satisfy long-term management needs. Once results are obtained and actions taken, a plan for maintenance and update of the system must be addressed. Norkiewicz (1994) suggests that, just as one person in the organization fulfilled the role of a "champion" in the implementation process, as Shields and Young (1989) suggest, one person should also be designated as the "custodian" of the system after implementation is complete. Someone in the organization must be assigned the responsibility for ensuring that the system evolves with the changes which occur as the organization acts upon the information. Cost drivers and activities need to be changed as new information about processes are revealed and improvements are made.

4.6 CONCLUSION

Implementing ABC requires the joining of various technical skills and organizational judgement and planning. As Shields and Young (1989) suggest, the introduction of a new costing system requires the coordination of the six "C's" of the change process. This comprises, Champion, Control, Compensation, Continuous Education, Commitment and Culture. A clear path for organizational change must be established by preparing an ABC implementation plan both in technical and organizational/behavioural terms. This chapter shows the multitude of factors where attention is needed in the implementation process. Each area discussed provides an opportunity for failure. According to Innes and Mitchell (1990c) the problems with implementation experienced in practice are a result of companies not preparing for it and not implementing sensibly. In addition, technology resources must also be evaluated to ensure the proper performance of computational and report functions.

Much of the literature stresses the importance of establishing management commitment to the process and of staff training as a precondition for successful implementation (Cooper 1990c, Turney 1992). Moreover, Bhimani and Pigott (1992a) suggest that implementation involves changing the attitudes and perceptions of organizational members. The technical mechanics of implementation must be combined with a full appreciation of organizational issues for the implementation to be successful.

In the following chapter the basic theoretical differences between a traditional system and an ABC system are discussed. In addition, the importance of reconciling these two systems is emphasized, and a possible model for accomplishing this is suggested.

CHAPTER FIVE

RECONCILING ABC WITH TRADITIONAL THEMES

5.1 INTRODUCTION

Users of cost management systems should be able to predict the economic consequences of their actions. Activity-Based Costing (ABC) systems have proven useful to management for making operational changes based on resource usage, but have failed to inform management about spending changes, and consequently about profitability. This is because ABC was designed to measure the rate of resource **demand**, not the rate of resource **supply** (spending). One of the most important established guides for performance measurement used by management, investors, and creditors, is profit. Management uses profitability to evaluate proposed courses of action, creditors use it to assess credit worthiness, and investors use it to determine potential return. Traditionally, costing systems have been designed to translate management decisions into pro-forma balance sheets and income statements. Indeed, the standard by which costing systems have been judged depends largely upon the accurate translation of management's actions into quantified statements of condition and performance. A cost system which does not meet this standard is deficient.

This chapter suggests that ABC systems can be adapted to provide profitability information.

A method for modelling the relationship between resource supply and resource demand, which permits activity-based decisions to be evaluated in terms of their expected economic consequences, is presented.

5.2 CONFLICTING VIEWS OF COST

ABC systems and traditional ledger systems provide two distinct views of cost. ABC systems provide a resource demand view, and traditional ledger systems provide a resource supply view. The resource demand view focuses on the resources consumed by performing activities, and the resource supply view focuses on the amount of organizational expenses incurred to make resources available for productive use (Kaplan 1994b).

Management must balance continuously the demand for resources with the availability of supply for those resources. It is necessary to understand how changes in demand from activities have an impact on the supply of resources in order to assess the potential profitability associated with proposed operational changes. Traditional approaches, such as contribution margin analysis and cost-volume-profit analysis, are used to inform management of the future economic effects of proposed decisions. At present, ABC systems fail to do this. This is because there is no established method for reconciling the resource supply view with the resource demand view. Both ledger systems and ABC systems provide important and unique perspectives on cost behaviour, and this author believes that integrating them would provide a more complete view. The aim of this chapter is to bring the two views of cost behaviour together by suggesting a method for linking changes in resources demanded by activities to changes in spending.

The chapter begins by using a simple linear equation to explain the early conceptions of the relationship between supply and demand. The equation is expanded by introducing the role of excess capacity, and its effect on spending changes. The equation is then evaluated for its faithfulness in representing spending changes when considering different degrees of supply flexibility and under the condition that no excess capacity remains. The key variables for estimating the incremental investment necessary to create new layers of capacity are then introduced. Finally, an integer function equation is used to explain the behaviour of resource supply and demand, when considering both supply flexibility and the role of capacity. This equation is used to model how changes in demand influence spending behaviour and to predict profitability from proposed courses of action.

5.3 NOTATIONS USED

In order to analyze the behaviour of resource supply and demand, a number of important variables need to be defined. Each variable plays a role in the developing argument. I have therefore given a specific notation to each in order to improve the legibility of the logical framework of this chapter. The variables, their assigned notation, and a brief definition are given below:

s_0 = current resource supply, expressed in monetary units
s_1 = expected future supply (spending), expressed in monetary units
d_0 = current demand, expressed in cost driver units[1]
d_1 = expected future demand, expressed in cost driver units
dc_0 = current demand capacity available, expressed in cost driver units
ISI = Incremental Supply Interval (ISI), the expected incremental investment necessary to accommodate a change in demand, expressed in monetary units
IDI = Incremental Demand Interval (IDI), the expected incremental change in capacity from a change in supply, expressed in cost driver units

Each variable, and its contribution to the argument, is explained more fully as they are introduced in the discussion.

5.4 THE ROLE OF EXCESS CAPACITY

Until recently, it was implicit in ABC methodology that changes in resource demand would

[1] Cost driver units refer to the occurrence of a particular event or transaction which is intended to measure the demand of resources. Cost driver units include the number of invoices, set-sups, batches, and purchase orders. The demand for an activity could be expressed by the number of cost drivers units that have occurred as a result of the performance of the activity.

result in proportional changes in resource supply (Kaplan et al. 1990b). It was assumed that expected supply (future spending) would be changed by the relative proportion of current supply (s_0) to current demand (d_0). This is expressed as follows:

$$s_1 = d_1 (s_0 / d_0)$$

For example, consider the activity of processing purchase orders. Assume that the current amount of total resources (expenses) traced to this activity is £5,000 (s_0) and the current number of purchase orders is 100 (d_0). If the number of purchase orders processed (resource demand) increases from 100 to 200, then management would expect spending to double. This is computed as follows:

$$£10000 = 200 (£5000 / 100)$$

After many attempts at applying ABC in this way, it was revealed that changes in cost driver demand greatly overstated the impact on spending (Cooper and Kaplan 1992b). Kaplan (1993) explains that these early problems were a result of confusion between resource supply and demand. He points out that when managers asked how much costs would change with respect to a particular decision (e.g. add or drop, change a process, or impose minimum order sizes), they were inquiring about spending changes in the short term. However, Cooper and Kaplan (1992b) argue that ABC was never intended to be used in this way. Rather, ABC systems were designed to measure the cost of **using** resources, not the cost of **supplying** them. The difference between resources supplied and resources consumed or demanded through activities represents unused capacity for the period. This is expressed in the following logic- statements:

Unused capacity $= s_0 - [(d_0 (s_0 / dc_0)]$ and

Used capacity $= d_0 (s_0 / dc_0)$ and consequently,

Current resource supply = **used** capacity + **unused** capacity. Expressed as,

$s_0 = d_0 (s_0 / dc_0) + s_0 - [(d_0 (s_0 / dc_0)]$ therefore, as long as current capacity (dc_0) $\geq$ expected demand (d_1),

Expected supply = expected demand + expected unused capacity. Expressed as,

$s_1 = d_1 (s_0 / dc_0) + (dc_0 - d_1)(s_0/dc_0)$

For example, recall that the total current resources supply to the activity of processing purchase orders is £5000 (s_0). If the capacity for the activity of processing purchase order is 400 purchase orders (dc_0) and the current demand is only 100 (d_0), then there is excess capacity of 300 (400 - 100). Therefore, increases in demand should not increase resource supply requirements until excess capacity has been reduced to zero. In this case, since excess capacity is greater than zero (300) then expected resource supply (s_1) is equal to current resource supply (s_0). This is expressed using the above equation as follows:

$s_1 = 100\ (£5000 / 400) + £5000 - [\ (100\ (£5000 / 400))] =$

$s_1 = £1250 + £3750$, and therefore, $s_1 = £5000$

According to this example, £1250 represents the cost of resources **used** and £3750 represents the cost of **unused** capacity. Therefore, only 25% (£1250/£5000) of the resource is consumed by the activity. As long as excess capacity exists, no increase in resource supply is expected. To illustrate this point further, assume that the number of purchase orders increases dramatically from 100 to 350. Using the equation above, the expected resource supply (s_1) is computed as follows:

$s_1 = 350\ (£5000 / 400) + (400 - 350)\ (£5000 / 400) =$

$s_1 = £4375 + £625 = s_1 = £5000$, and therefore

Expected supply (s_1) remains equal to current supply (s_0)

Even as resource demand increases from 100 to 350 purchase orders, the level of recourse supply remains the same at £5,000. In this example, there has been an increase in the level of resources consumed by the activity, which has resulted in a reduction in the cost of unused capacity from £3,750 to £625, but no change in spending has occurred.

5.4.1 Spending reductions. The same phenomenon holds true when management redesigns activities and processes to reduce the number of cost driver units. For example, assume that management finds a way to reduce the number of purchase orders from 350 to just 75. This is computed as follows:

s_1 = 75 (£5000 / 400) + (400 - 75) (£5000 / 400)

s_1 = £937 + £4063 = s_1 = £5000 , and therefore

Expected supply (s_1) remains equal to current supply (s_0)

Note that even when demand is reduced significantly, the expected supply requirement remains at £5,000. This is because the reduction has only resulted in an increase in excess capacity without affecting spending. Spending reductions can only be obtained by management taking action to limit the level of supply to the activity through budgetary adjustments, not by simply reducing demand (Theeuwes and Adriaansen 1994).

5.5 CONSUMPTION PATTERNS

The above illustrations deal with changes in demand while excess capacity exists. We saw that, as long as excess capacity remains, significant increases or decreases in demand will not result in changes in spending. However, not all resources supplied to activities result in excess capacity. Cooper and Kaplan (1992b) describe two ways in which resource supply is adjusted to meet activity demand. The first way is by supplying resources in advance of demand which exhibits a **pushed** consumption pattern. The second way is by the activity initiating supply as it is needed which exhibits a **pulled** consumption pattern.

5.5.1 Pushed resources. A resource is **pushed** when resources are supplied in advance of demand to accommodate unknown future usage. For example, a building is purchased in advance of expected floor space needs. How much actual floor space is required is an unknown future variable. Management may attempt to supply resource capacity which approximates the expected resource demand, or it may deliberately invest in excess capacity in anticipation of future increases in demand (McNair 1994). Acquiring excess capacity may prove to be the most economical method of anticipating future demand. When resources are pushed, inevitably supply and demand will be unequal, and either excess capacity or deficit capacity will result. Excess capacity occurs when management supplies resources to an activity in excess of the rate at which the activity is able to consume them. Managerial judgment for pushed resources is required at two stages. First, at the budget stage to decide how much initial resource is to be supplied, and second at the adjustment stage when management attempts to balance supply and demand by cutting expenses or providing additional support (Kaplan 1994a).

5.5.2 Pulled resources. A resource exhibits a **pulled** consumption pattern when demand initiates supply. A pulled resource is therefore supplied as a function of usage. For example, utility related resources, such as telephone and energy expense, are supplied as they are used. There is no separation between supply and demand, and thus no excess capacity or deficit-capacity exists. Generally, when an organization supplies resources through external suppliers without long-term commitments, a pull phenomenon exists to some degree. This is because the supply of resources can be increased or decreased quite quickly, limiting the potential gap between supply and demand. Consequently, limited additional managerial judgment, either at the budget stage or at the adjustment stage, is required to address supply and demand equilibrium. Additional resources are supplied almost automatically as the demand requirements change. Examples of pulled resources include flexible labour costs, energy costs, telephone costs, and even fees paid to an outside supplier of a short-term service contract.

Clearly, the extent to which a resource is **pushed** or **pulled** depends on the degree of supply flexibility. The more ability management has to control resource supply levels and adapt them to demand fluctuations, the more the resource exhibits a pulled resource consumption pattern. Figure 5.1 shows the basic relationship between consumption patterns, excess capacity, and flexibility:

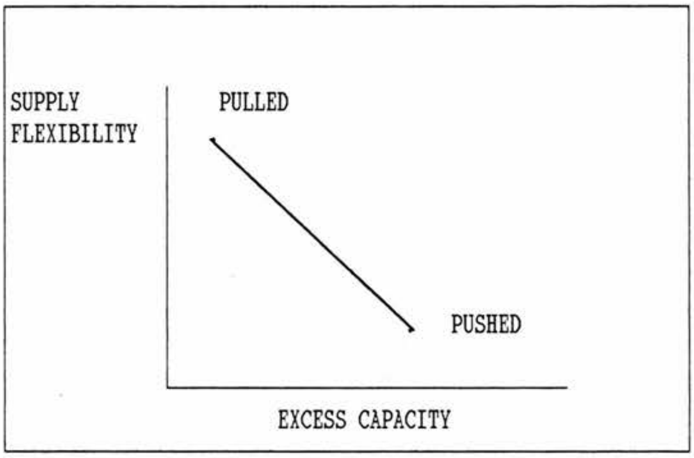


Figure 5.1

If a resource exhibits a highly pulled consumption pattern, then excess capacity is expected to be small. On the other hand, a highly pushed resource is very inflexible with respect to demand fluctuations, and is likely to result in significant levels of excess capacity. Therefore, highly pulled resources are likely to behave in a way initially conceived by early users of activity information, that is, changes in demand will result in proportional changes in supply, which is represented by the equation $s_1 = d_1 (s_0 / d_0)$.

For example, consider a highly pulled resource such as telephone expense. If the current level of call units used increases from 50 to 75 (an increase of 50%), then the current resource supply is likely to increase from £2,000 to £3,000 (an increase of 50%). This is computed as follows:

$$S_1 = 75\ (£2000 / 50) \;=\; S_1 = £3000$$

On the other hand, highly pushed resources are more likely to behave in a manner consistent with the more refined equation which includes the excess capacity component which is represented by the equation $s_1 = d_1 (s_0 / dc_0) + (dc_0 - d_1)(s_0/dc_0)$.

For example, consider a highly pushed resource such as an executive salary. Assume the current annual salary of the executive is £40,000 with a working capacity of 2000 hours per year. Although the current hours worked may increase from 1600 to 1900 the expected supply requirement is expected to remain the same. This is computed as follows:

$s_1 = 1900\ (£40000 / 2000) + (2000 - 1900)\ (£40000 / 2000) =$

$s_1 = £40000$

As long as excess capacity exists, there remains a buffer forestalling spending changes and permitting demand from activities to increase or decrease without affecting resource supply. However, when current capacity reaches zero, the prediction of spending changes requires the modification of the simple linear equations described above.

5.6 WHEN EXCESS CAPACITY REACHES ZERO

As explained above, the economic consequences of expected changes in demand on highly pulled resources can be reasonably predicted using the liner equation $s_1 = d_1 (s_0 / d_0)$, which makes the issue of excess capacity less relevant. In addition, changes in expected demand on pushed resources when excess capacity exists can be predicted using the equation $s_1 = d_1 (s_0 / dc_0) + (dc_0 - d_1)(s_0/dc_0)$, which includes the excess capacity component and permits changes in demand without affecting spending. The question now becomes how do pulled resource supply levels behave in response to expected increases in demand when that demand is expected to exceed current capacity limits. In other words, how much additional spending should be expected to accommodate projected increases in demand beyond current capacity? Or perhaps more importantly, what spending reductions are possible with respect to proposed reductions in resource demand? These are the initial questions that early users of activity information were most interested to have answered.

In order to answer these questions, the equations above need some modification. Two additional variables are needed to express the incremental changes in investment necessary to create new levels of resource capacity to accommodate projected increases or decreases in demand. The first variable is called the ISI (Incremental Supply Interval), which represents the estimated incremental change in spending (expressed in monetary units) necessary to accommodate the expected level of capacity from d_0 to d_1. The second variable is called the Incremental Demand Interval (IDI), which represents the incremental change in capacity (expressed in cost driver units) made available from a change in spending.

5.6.1 Estimating the ISI and the IDI. A new layer of capacity could be expressed both in monetary terms and in cost driver terms. The ISI represents the incremental monetary investment necessary to increase capacity to accommodate projected increases in demand from activities beyond the current level of capacity. It could also represent the opportunity for incremental cost savings in response to decreases in demand below capacity. The IDI could be thought of as the ISI expressed in cost driver units.

The ISI is formulated by analysing the market acquisition characteristics of a particular resource. The market acquisition characteristics are the limitations and peculiarities of the market place which are confronted when acquiring new capacity. It is these characteristics which determine the degree of supply flexibility (Corbey 1991). For example, consider the prospects of adding new personnel resources (salary expense) to the activity of processing of purchase orders. The market place for acquiring human resources does not permit people to be hired in excessively small increments. At best, some markets allow for part-time or temporary employment. Therefore, the ISI for this resource/activity relationship could be the cost of hiring a part-time or temporary purchase order clerk. Since the market place does not permit hiring workers to process only a few purchase orders it is likely that excess capacity will have to be acquired. For example, assume the current supply of resources is one clerk at £10,000 per year who has a capacity of processing 100 purchase orders. Further assume that management expects the demand of this activity to increase from 100 to 115 purchase orders. Since the market characteristics for acquiring human resources does not permit employing a worker to process only 15 purchase orders a year, management would have to invest in excess capacity by employing a part-time worker who may have the capacity to process 50 purchase orders (the IDI) for a cost of £5000 (the ISI) a year. In this case, management is forced to purchase excess capacity of 35 purchase order (50 - 15).

The more a resource exhibits a pushed consumption pattern, the less responsive supply adjustments are to changes in demand, and the larger the ISI value. The ISI for acquiring a purchase order clerk is small in comparison to ISI for acquiring a facility related resources such as office space.

5.7 MODELLING RESOURCE/ACTIVITY RELATIONSHIPS

In order to model changes in highly pushed resources, the ISI and the IDI variables must be integrated in the equation. The equation must express the changes in supply and demand in relation to the level of capacity. Expected supply (s_1) could be predicted by modelling the changes in demand using the following step function equation:

$$s_1 = ISI \{ d_1 / IDI \} + ISI$$

where the brackets **{ }** denote an integer function (e.g. $\{3.1\} = 3$ and $\{3.9\} = 3$)

For example, consider again the activity of processing purchase orders. In the interest of simplicity, assume that only two resources have been traced to this activity: A highly pushed resource, office rent in the amount of £10,000 per year; and a highly pulled resourse, telephone expense in the amount of £6,000 per year. Further assume that these resources allow for a maximum (current capacity) of 400 (dc_0) purchase orders to be processed per year. Processing purchase orders beyond this point without additional resources would result in some form of organizational pain, such as delays and other forms of quality erosion, indicating to management that the practical capacity threshold has been exceeded (Kaplan 1994b, McNair 1994). The question is, if management expects to be processing 600 purchase orders next year because of new business, how much new spending would be required to accommodate the increase in demand from this activity?

To analyze the impact on spending, each resource must be considered separately as it relates to the demand from the activity, thus forming a unique resource/activity relationship. Because telephone expense is a highly pulled resource, excess capacity is likely to be zero (or close to zero) and thus would exhibit a different cost behaviour pattern than office rent. Therefore, expected spending with regard to telephone expense could be reasonably predicted using the linear equation; $s_1 = d_1 (s_0 / d_0)$ described earlier. This is computed as follows:

$$s_1 = 600\ (\ £6000 / 400) \;=\; s_1 = £9000$$

The supply and demand relationship is expressed as a smooth upward slope and is presented in Figure 5.2 below:

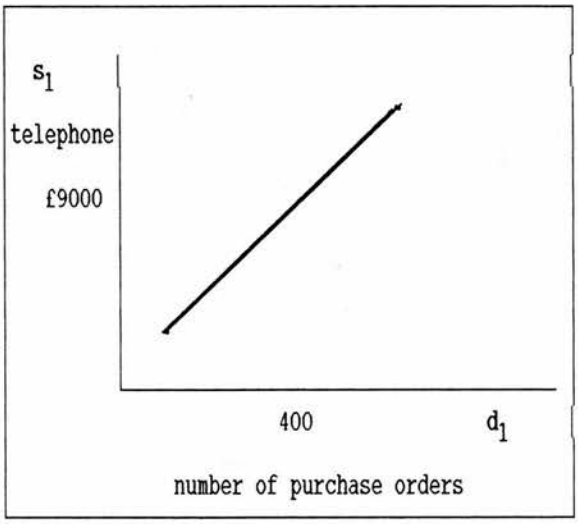


Figure 5.2

For any value of d_1, a proportional change in s_1 occurs. For example in figure 5.2, the slope is expressed as $s_1 = 15(d_1)$. Therefore, if d_1 is equal to 100 then s_1 is equal to 1500, and if d_1 is equal to 101 then s_1 is equal to 1515.

Spending changes for office rent will most likely result in excess capacity because physical facilities can not be supplied in small increments. In order to add more floor space to accommodate increases in demand, management must invest in new facilities by either buying or renting office space. Assume that management estimates that a future incremental layer of capacity would require an investment of £8000 (the ISI) which would permit an estimated increment of 350 (the IDI) additional purchase orders to be processed. By using the step function $S_1 = ISI \{ d_1 / IDI\} + ISI$, a model of the supply and demand could be constructed. Any value for estimated demand could be plugged into the equation to get a value for supply along the step function slope. This is the resource/activity relationship presented in figure 5.3 below:

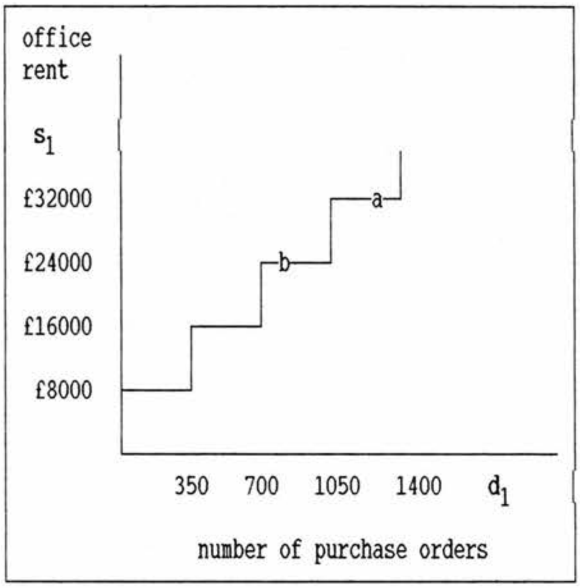


Figure. 5.3

The level of spending will depend on whether the current layer of capacity is greater than or equal to zero. If no excess capacity exists, a change in demand will result in a change in supply by the value of the ISI. In contrast, if excess capacity is greater than zero then s_1 will be equal to s_0 and no new spending is required. For example, when d_1 is equal to zero then s_1 is equal to £8000, and when d_1 increases to 349 then s_1 is still equal to £8000. However, once demand reaches 350 (dc_0), then excess capacity has been reduced to zero ($d_1 = dc_0$), and spending jumps up to £16,000 creating a new capacity layer.

The vertical jumps in the slope steps represent the ISI and the horizontal movements represent the IDI. The step function in figure 5.3 indicates that changes in demand will not have an impact on supply until current capacity reaches zero. Once capacity is reached, the change in supply would be equal to the value of the ISI. Highly pulled resources in which supply is very flexible with demand would have very small vertical jumps in the line, indicating a small ISI value. In fact, a purely pulled resource would be depicted as a smooth upward sloping line without steps, and with an ISI equal to zero. In contrast, highly pushed resources would exhibit larger vertical jumps in the slope, depicting the inflexibility of supply to changes in demand from activities.

Using the model in figure 5.3, spending requirements can be estimated for both increases and decreases in projected demand. For example, if the number of purchase orders grew significantly to 1300 (at point 'a' in figure 5.3), the level of spending required to accommodate this demand would be estimated at £32,000. This is computed as follows:

$s_1 = £8000 \{ 1300 / 350 \} + £8000 = \quad s_1 = £32000$

On the other hand, if management discovered a way to reduce the number of purchase orders through process redesign efforts to 800 (at point 'b' in figure 5.3), the necessary supply level would be reduced to £24,000, resulting in the opportunity for saving of £8,000 (£32000 - £24000). This is computed as follows:

$s_1 = £8000 \{ 800 / 350 \} + £8000 = s_1 = £24000$

where potential savings is equal to: $s_0 - s_1$

Note that changes in demand for pushed resources are not proportional to changes in supply. Rather, changes in spending depend upon the degree of supply flexibility. Market characteristics determine the extent of flexibility, and therefore the size of the ISI and the IDI. Using these variables in a step function equation provides a model for predicting the economic consequences of proposed operational decisions which involve changes in demand from activities.

5.8 INTERDEPENDENT RESOURCES AND ACTIVITIES

So far the model has assumed a one-to-one relationship between a resource and an activity. Clearly, the organizational environment is more complex, involving many interrelated connections between resource supply and demand. Organizational resources are consumed by many activities in the company and, consequently, an activity cost may be composed of a combination of varying degrees of pushed and pulled resources. In addition, each activity is likely to have a different cost driver representing the consumption of resources assigned to the activity. The model essentially attempts to express the change from d_0 to d_1 by quantifying the change from s_0 to s_1, using the ISI and the IDI inside a step function equation. However, since there is likely to be more than one resource traced to a specific activity, the economic consequences are likely to involve many different spending/activity relationships. Therefore, the total spending change which results from operational changes in demand is composed of the changes in s_1 for every resource affected by the change. This is expressed as follows:

Total spending = s_1 of resource A + s_1 of resource B + s_1 of resource C... or

Total spending = $\sum s_1$, therefore total change in spending could be expressed as:

$\Delta S = (\sum s_1 - \sum s_0)$

In order to use the step function described above to predict spending behaviour, proposed operational decisions must be translated into cost driver terms. Thus, the cost drivers can serve as the linking mechanism for reconciling resource supply and demand. Applying this concept in practice requires a three step process.

1. Determine cost driver impact. The decision or proposed action must be translated into a set of estimated cost driver changes. For example, if management is considering a new product line, an estimation of how many new purchase orders, machine-set-ups, invoices, batches, and sales calls is needed. Similarly, if management discovers a way to improve the production process, an estimation of how many labour and machine hours, set-ups and stock movements can be saved is needed.

2. Determine relevant activities. Relevant activities are those which are driven by cost drivers which are expected to change as a result of the proposed action. For example, if the proposed action requires more purchase orders to be processed then the activity of

processing purchase orders becomes a relevant activity. Similarly, if an increase in the number of sales calls is expected, the activity of making sales calls becomes relevant to the decision.

3. Establish a step function relationship between relevant activities and resources. A step function equation using ISI and IDI variables must be established for each resource that is traced to each relevant activity. However, when a single resource is traced to more than one activity, the relationship with the largest ISI must be used to estimate the change in spending. For example, if both the activity of making sales calls and the activity of processing purchase orders require an increase (according to the ISI), in the demand for telephone service, then the new capacity must be the activity relationship which places the highest demand upon the resource. The process is summarized in figure 5.4 below:

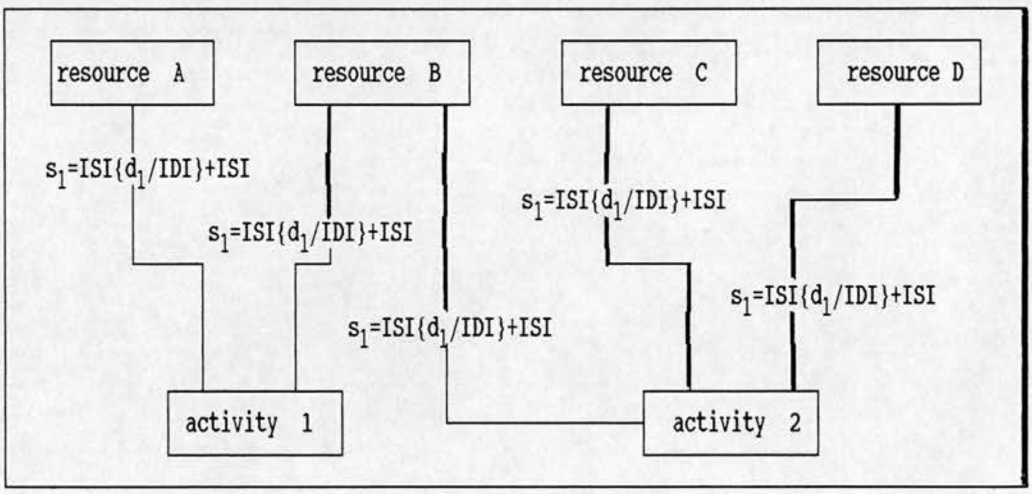


Figure. 5.4

A step function exists for each activity/resource relationship. When a single resource (resource B) is consumed by more than one activity, more than one relationship exists and therefore more than one step function is needed to express it. However, since the new capacity of resource B is being determined from changes in demand from activities 1 and 2, only one relationship must be selected to predict spending changes. The relationship which requires the largest new spending is therefore the new capacity needed to satisfy the new demand.

5.9 CONCLUSION

Although the aim of ABC has historically been restricted to product costing, in recent years it has expanded into the management arena in the form of Activity-Based Management (ABM) (Cooper 1990c, Brimson 1991). Users of ABC began to realize the utility of using activity information for evaluating management decisions. As ABC began to be used in this way, it was erroneously believed that it could be used similar to the way in which contribution margin and cost-profit-volume analysis are used (Noreen 1991). These traditional approaches provided management with information for assessing the economic consequences of proposed decisions, such as make-or-buy, drop-or-add, special order, scarce resource, and sell-or-process-further decisions. The fact that the early users of ABC systems attempted to use activity information in this manner underscores the necessity of having a cost management system to provide profitability information in a decision making context.

The expansion of ABC as a decision making tool raises the standard of ABC information and requires that it support the decision maker by providing estimates on the profitability associated with certain proposed courses of action. It has been argued that ABC, even in its evolved ABM form, was never intended to provide short-term profitability information. Instead, Johnson and Kaplan (1987b) give a vague impression that over the long-term, changes in demand will ultimately affect spending. However, Corbey (1991) suggests that although this argument is correct in principle, "it is precisely this long-term situation that is so unpredictable". Consequently, changes in demand may never effectively be linked to changes in supply in the long-term.

This chapter also give some insight into how to determine the cost of resource usage and the cost of excess capacity. By calculating the cost of resources used in the conversion process, management can evaluate special order type decisions more effectively. For example, knowing the level of excess capacity would help determine whether to accept or reject a special customer order at a price below full cost. Traditional analysis preaches the acceptance of orders which merely cover variable costs as long as excess capacity exists. However, when faced with this problem, management has often lacked a method of calculating current capacity. In addition, possessing quantifiable measures of capacity may offer a new avenue for performance evaluation, which may lead management to focus on increasing resource supply flexibility.

The model presented in the chapter is a form of incremental analysis, but differs considerably from traditional applications. Traditional incremental analysis bases incremental change on unit volume. Costs are split into variable and fixed according to their relationship to the expected number of units produced. In contrast, the incremental analysis here does not restrict the activity basis to unit volume alone. Instead, the incremental impact is a function of cost to a unique cost driver. Therefore, expected spending changes are not exclusively dependent upon changes to unit volume.

No accounting system or model actually makes decisions, but all are directly or indirectly intended to support the decision making process. Kaplan (et al. 1990b) argues that ABC is not a decision focused system, but rather a general purpose system. However, his claim is more of a consequence rather than a design feature of ABC. Kaplan explains that incremental analysis is too complex and consequently not worth doing. But this is precisely why models are useful. To simplify and reduce complexity, sacrificing absolute accuracy for relative clarity.

Incremental analysis is used frequently in a decision making context in the form of contribution margin analysis, cost-volume-profit analysis, and break-even analysis. These models are based on simplifying assumptions that give guidance to management decisions.

Businesses do not only rely on these models to break down complexity, but more importantly, to provide insight into future economic consequences of proposed courses of action. Regardless of the system or model employed, profitability remains the primary measure of quality management decisions.

The model suggested in this thesis is not intended to consider all possible variables, but rather to merely provide a simplified view of the problem in order to aid in the decision making process. The model is limited to resource/activity relationships and does not consider the relationship between activities and products. It is intended to provide a link between changes in operations and spending changes (e.g. process re-design, elimination or modification of activities, reduction of cost driver transactions, and resource adjustment and re-allocation).

In an ABC system, cost drivers are used to establish a cause-and-effect relationship between each resource (or group of resources) and each activity (or group of activities). Although this process is very complex, it is exactly how ABC systems are built. The chapter suggests that in addition to cost drivers, a step-function could be established for each resource/activity relationship that could be used to model changes in spending. Therefore, no new relationships are necessary.

As with any model, the step function approach described in the chapter is an oversimplification of reality. It reduces the complex and dynamic organizational environment to a system of predictable outcomes supported by a set of assumptions. There are a number of assumptions used in the model which could be questioned. For example, the ISI is assumed to be constant for each layer of demand. However, the market characteristics for acquiring resources are likely to fluctuate over time. For instance, the cost of office rent may increase over time as property values rise in response to economic conditions. In addition, the degree of supply flexibility may change as management perfects its control over spending, transforming pushed resources into pulled resources. An example of this has occurred over the last decade as businesses began to make extensive use of temporary workers. This has increased management's ability to adjust resource supply with demand. In spite of these assumptions and oversimplifications, the model can be a useful tool for decision making, as long as its limitations are considered.

As Cooper (1990b) suggests, the measure of a cost system should be how useful it is to the organization. ABC provides management with useful information about how activities drive costs. This new way of viewing the organization has helped management understand and control overhead costs. However, one of the most important aspects of a costing system is to provide management with a tool for dealing with uncertainty. In an increasingly volatile and competitive market, management needs, as never before, tools to help make decisions in the face of this new uncertainty. Proposed courses of actions need to be analyzed and projected into the future before the changes are implemented. ABC systems have used technology to bring new visibility to cost behaviour. Just as engineers use computer simulation to test their building designs before they are built, and doctors use computer technology to perform mock operations before engaging in dangerous surgery, so too should management possess a system which enables them to test the consequences of their decisions before they are unleashed to the uncertainty of the organization and the market place.

In the following chapter the applicability of ABC is expanded into a more general management arena to take the form of Activity-Based-Management (ABM).

CHAPTER SIX

ACTIVITY-BASED MANAGEMENT

6.1 INTRODUCTION

Activity-based costing (ABC) was originally narrowly defined as a product costing tool (Cooper 1988b). Its main purpose was to overcome the distortions caused by traditional allocation approaches yielding more accurate product costs. By expanding the notion of the "cost object" to other areas, and by applying the ABC method in other ways, a new dimension of activity accounting was introduced. Product cost was no longer the sole object of measurement, the system's nature and application became broader and more relevant to many areas of managerial activity. Thus, ABC evolved into Activity-Based Management (ABM) as managers and academics began to see the applicability of activity costs for evaluating the profitability of customers, markets, business processes, and distribution channels. In addition, activity information was seen as a means of influencing behaviour in cost effective ways (Beynon 1992), as a basis for formulating and using budgets (Bellis-Jones 1989, Brimson and Fraser 1991), and as a basis for a range of management decisions (Mitchell 1994b).

This chapter summarizes the potential contributions which activity-based information can make towards managing the firm. The chapter begins with a discussion of how activities can be analyzed to formulate useful management information. It moves on to show how ABM is integrated with other management techniques in a decision making context. The chapter concludes by outlining possible ABM applications to major areas of managerial interest, such as process re-engineering (Ligus 1993), cost reduction programs, decision making, management initiatives such as TQM (Steimer 1990), and performance evaluation and control (Innes and Mitchell 1991b).

6.2 THE BASICS OF ABM

Activity based accounting can serve both as a more accurate product-costing tool and as a performance improvement tool. These two purposes stem from the capacity of ABC to accurately trace the resources consumption pattern within an organization's activity framework. Activity-based management is the utilization of this activity cost information to manage the organization. However, ABC and ABM can not be easily separated from each other. The ABC process of collecting, analysing, and calculating activity cost is also part of the process of management through ABM. In other words, ABC and ABM are two aspects of the same basic system. ABC supplies the activity cost information necessary to apply ABM techniques to improve the business process. Re-engineering, bench-marking, performance measurement, and customer analysis are just some of the applications of ABC information being used as ABM.

ABM has two direct goals. The first is to improve the value of products, and services provided, to the customer. The second is to improve profits (Turney 1992). Both of these targets are achieved by managing activities within the organization as, theoretically, each activity, in some way, contributes to these goals. For example, each activity should make a measurable contribution to satisfying customer needs profitably. Employing activity-based information to assist in the management of a company involves the strategic deployment of resources to the activities which yield the maximum strategic benefit, and the sustainment of those activities which add the most value to the customer (Yang and Wu 1993). To achieve this, activities have to be analyzed to identify those which are non-essential and those which are key (Kaplan 1987). The use of bench-marking and various analysis of the business process provide a means for doing this (Johnson 1988).

6.2.1 Identify non-essential activities. According to Berliner and Brimson (1988), activities in an organization can be directed to satisfy two targets. Either the activity is performed to satisfy the final customer in a fairly direct and obvious way, or it is performed to permit the organization to function properly. If the activity does not satisfy either of these functions it may be considered non-essential. ABM involves the identification of these non-essential activities as a prelude to the investigation of ways to reduce or eliminate them (Clark and Baxter 1992). For example, a manufacturing activity such as, conditioning leather seats may satisfy customers' functional requirements whereas, in contrast, the activity of preparing financial statements is a necessary activity which permits the organization to continue to function effectively within the law. Activities which involve correcting or checking product defects are activities which add no value to either the customer or the organization should be considered as candidates for non-essential activity designation (Aitken 1991).

6.2.2 Examine key activities. There are many activities performed in an organization. According to Turney and Stratton (1992), the most effective means of making improvements to the business process is by focusing firstly on the activities which have the biggest impact on cost. ABC data can be used to identify these significant activities, often for the first time. All things being equal, the higher the activity cost, the larger the potential cost savings which may result from process changes (Anotos 1992). For example, ARCO

Alaska Inc. (Cooper and Kaplan 1992a) ranked each activity cost as a percentage of total costs. It was discovered that the activity of processing accounts payable invoices accounted for the largest percentage of total costs. ARCO focused on this activity and attempted to reduce the number of cost driver transactions. It was particularly important for management to focus first upon the activities which were most cost significant as they had the potential to yield the largest return in terms of cost savings. This approach was considered necessary to gain top management support by justifying the ABC project financially. In contrast, cost data percentages also informed management that the activity of financial reporting accounted for less then 1% of total costs, and therefore it could be largely ignored in the initial stages.

6.2.3 Bench-mark key activities. Watson (1992) describes bench-marking as a technique used by management to evaluate various internal performance measures of the firm against outside companies which possess a reputation for excellence. Using this, companies can compare their activity performance with similar activities of other companies (Cokins et al. 1992). In addition, activity bench-marking could be applied to compare various departments or divisions in a single firm. Bench-marking is used in an ABC environment because it is difficult for companies to determine the appropriate level of performance for a specific activity of the business (Burch 1994). For example, a company which calculates a cost of processing a purchase order will not necessarily know if the cost is high or low. This makes it difficult to assess which activities need the most attention. Using activity information measures from companies outside the organization permits targets or bench-marks to be established. These then provide a reasonable internal standard for activity cost performance. Mak and Roush (1994) suggest that setting targets in this way also helps companies create reasonable standards to use as a basis for an activity-based budgetary control system. Activity-based budgeting involves the use of specific activity standards which can be compared with actual activity performance (Kaplan 1994a).

Bench-marking programs have been in use for a number of years and utilize traditional financial information, such as return on investment, inventory turnover, and cash flow measures. For example, Xerox has been involved with an extensive bench-marking program for over fifteen years (Xerox 1984). In contrast to bench-marking involving traditional financial information, the use of activity information in a bench-marking program can often be more problematic. Cokins et al. (1993) argue that this is because activities tend to be unique to each company. Thus, activity cost measures are difficult to accurately compare from firm to firm. In order to engage in effective activity-based bench-marking, an extensive amount of cooperation is necessary. Activity names and meanings must be predefined and standardized in advance. In addition, standard cost drivers and resource allocation methods must be established. The other problem involved in using activity-based bench-marking is that the information is frequently sensitive and full disclosure may be inhibited. Special care must be observed to ensure each participant's security in the program.

6.2.4 Analyze processes. Certain activities are linked in a interdependent value chain designed to accomplish a common goal (Yoshikawa et al. 1993). The connection between activities should be examined to increase cross functional cooperation, minimize duplication of work, and also to reduce the effects of bottlenecks (Salafatinos 1995).

In traditional environments, functional barriers divide the organization into separate and distinct parts (Johnson 1990). For example, the Engineering Design Department conceives of and drafts a new product, the Production Department assembles it, and the Marketing Department advertises and sell the product. Each department performs their expertise with little cooperation from the other. Analysing the business process requires interacting information from different functional areas of the company to coordinate complex connections between activities (Greenwood and Reeve 1994). Activities performed in separate parts of the company may be part of a single process which crosses many departmental borders. Parker (1993) argues that examining activity transaction flows may reveal sub-optimal links between activities. For example, the Design Department may be designing products which are too costly to produce. The production machinery may not be adequate for fabrication of the design. Moreover, the Marketing Department may have targeted selling a product at a certain price which may not be reached if production costs are too high.

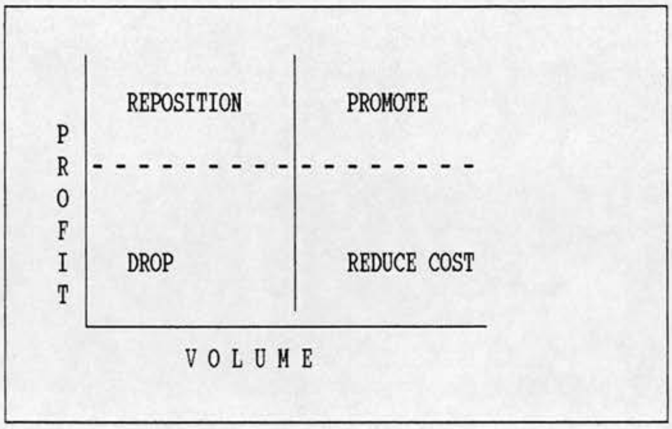
Identifying activities and then establishing provider/user links between them can contribute to the solution of this type of problem (Bellis-Jones 1990). Morrow and Hazell (1992) suggest the use of activity maps for process redesign. Activity mapping is a graphical representation of the connecting activity links in a process. For example, Pacific Bell (Johnson et al. 1990) used process analysis to examine the accounts payable process. They discovered that 25% of the effort was devoted to processing less than 1% of the vendor invoices. In addition, several transactions were performed twice, once within the Accounts Payable Department and again in the Purchasing Department. To address this problem, work flow diagrams (similar to activity maps) were used to redesign the process. Individual work cells were proposed for each type of payment processing. The emphasis was on reducing the bottlenecks and increasing the flow of operations without interruption or duplication (Goldratt and Cox 1984).

6.3 INTEGRATING ABM WITH OTHER MANAGEMENT TECHNIQUES

Using ABM in the management of an organization requires the marriage of traditional management techniques with activity information (Mabberley 1992). ABM combines activity-based information with traditional techniques to enhance managerial performance. Strategic analysis, value-added analysis, cost analysis, budgeting, life-cycle costing, and target costing can all be used in conjunction with activity-based information and traditional management techniques to increase the competitive advantage of the firm.

6.3.1 ABM and Strategic analysis. ABC information gives visibility and perspective to the ways in which the resources, constituting overhead, are used to support corporate objectives. Strategic analysis is designed to permit management to evaluate and examine the relative link between operational activities and the general mission and objects of the firm (Shank and Govindarajan 1989). Product strategy, pricing policy and customer strategy are all ways to fulfil the corporate mission, and have operational implications to which ABM can be applied.

It has been documented in many case studies of ABC implementation that complex low volume products tend to be under costed, and simple large volume products tend to be over costed (Cooper and Kaplan 1992a, Turney 1992, Bromwich and Bhimani 1993). Understanding product cost more precisely can facilitate a more effective pricing strategy. For example, complex low volume products may have to be re-engineered to lower the cost, or re-priced to protect margins. Simple higher volume products could provide an opportunity to increase margins, or be re-priced at a lower competitive price to capture more market share. For example, the Oscilloscope Group of Tektronics (Jonez and Wright 1987) faced an intensely competitive market environment. Market share was highly dependent upon price. Tektronics used ABM product analysis to determine the most accurate costs for each product. The company found that many of its speciality lines were losing money. Other product lines were discovered to be under-priced and so offered a potential increase in profit margins. Figure 6.1 below highlights the relationship of profit and volume as one input to product strategy.



(Figure 6.1) (Turney 1992)

According to Turney (1989), by analysing the levels of product profitability, product strategy can be assessed in terms of re-positioning, promoting, dropping, or reducing the cost. For example, if a product is determined to be a high margin item, but is sold in small volume, the product may need to be re-positioned. On the other hand, if the product is produced in high volumes but at small margins, the product may require cost reduction.

Bellis-Jones (1989a) suggests that identifying the customers as the cost object allows customers to be evaluated in a similar way to the product strategy approach described above. Different customers consume resources at different levels. Some customers are serviced with a minimum amount of effort, while others require extensive processing, distribution, and production effort. For example, the cost of different distribution channels were examined at Winchell Lighting Company (Cooper and Kaplan 1991b). Certain customers, who were believed to be highly profitable, were discovered to be generating negative margins once the full complexity of distribution cost was included in the cost calculations. By defining the customer as the cost object, activity costs could be traced to customers, or groups of customers, to determine the relative cost of servicing them (Bellis-Jones 1990). This would improve profitability and competitiveness by recognizing that the cost of the product includes the overhead costs relating to the serviced customer as well as the direct costs associated with the product or service.

Foster and Mahendra (1994) argue that traditional cost accounting has historically under emphasized the importance of customer profitability. Rather, profit reporting has focused primarily on business segments or functional components of the internal organization. The advantage of customer analysis is that it joins both the internal costs of production with the external costs of the market place, and links cost accounting to strategic analysis (Yoshikawa et al. 1993).

6.3.2 Value-added analysis. Each activity performed in the organization should ideally possess some degree of value from the perspective of the end customer. However, the definition of value can be highly subjective. Indeed, Cooper and Kaplan (1992a) outline a number of unique definitions used by different companies. For example, some common definitions for "value added" include an activity that adds value in the eyes of the customer, an activity that is performed as efficiently as possible, or an activity that supports the primary objective of producing outputs.

Whatever meaning is attached to "value", some activities contribute a much higher level of value than others. Activities can be examined to determine the relative level of value added to the product or organization. Those activities identified as low value added could either be targeted for elimination or redesign. However, Walker (1991) suggests that identifying the level of "value" is a difficult matter. The relative contribution an activity makes to the organization is open to interpretation. For example, the activity of disposing of damaged material may be considered value added to the production manager. In contrast, corporate administrators may view this as an activity which possesses no value. It is thus often impractical to classify activities simply as either value-added or non-value-added as many suggest (Yoshikawa et al. 1993). Christensen and Sharp (1993) argue that refinement may be possible if the value-added dichotomy is broken down into degrees of value, such as high, medium, or low, or even ranked along a scale from one to ten. This permits management to address the lowest level activities first and work their way up the hierarchy.

Value analysis is a form of attribute coding often associated with ABC systems. By coding activities in terms of value, the computer generated information can be sorted and summarized in accordance with the coding specifications (ABC Power specification manual, Armstrong Laing Systems Ltd.). Activities could even be coded to collect information about the character of the operation. For example, reason-codes could be used to justify specific resource allocations. General Electric (Turney 1992) used value analysis to improve performance in a number of functional departments. Each activity was classified according to the value to the department perceived by the internal customer. In addition, Bellis-Jones and Hand (1989) suggest that an assessment of activities could be made using categories such as "core", "support" and "discretionary". The "core" attribute represents the primary purpose of the activity. The "support" attribute describes those activities which support the core activities. The "discretionary" attribute is used to identify those activities which could be eliminated, given improvements in the operational process, without hindering the organization from achieving its objectives.

Yoshikawa et al. (1994) take value analysis further by suggesting that resource consumption can be compared with the relative functional value given to internal or external customers by a product or service. The idea is that if the relative cost of the function exceeds the relative importance perceived by the customer then the function should be targeted for cost reduction.

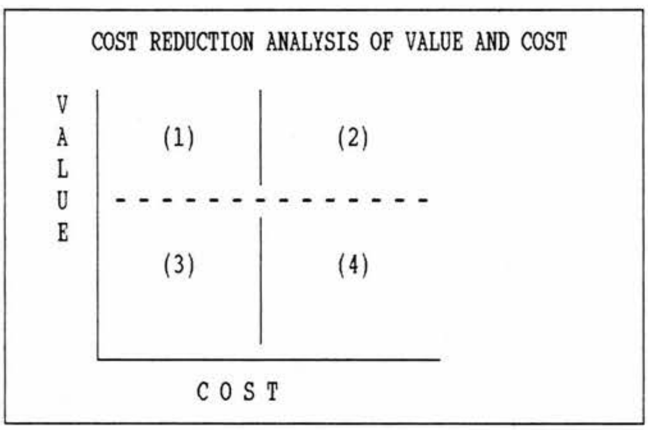
Value analysis, and other forms of attribute coding, can help management organize important information to improve the work operations, increase productivity, and improve financial results. Value analysis is an ABM tool which provides a vehicle for focusing management attention on non-financial as well as financial information (Clark and Baxter 1992).

6.3.3 ABM and Cost analysis. Cost analysis is an ABM tool for controlling and reducing costs. Activity information can help reduce cost in three ways. First, by directing attention to those activities which have the largest impact on cost. Second, by categorising activities in a value hierarchy. Third, by using cost drivers to measure and monitor the effects of cost reduction efforts.

A bill of activities represents the cost components for a particular cost object. It is similar to a bill of materials but includes a list of activity costs rather than material costs. For example, the TriQuit Company (Riley and Turney 1990) identified three activity components for the Laminates cost object. The activities included setting up the laser at a cost of £5400, cutting the laminate at a cost of £21075, and testing the cut at a cost of £7300. By examining the bill of activities, the largest cost items can be identified, and prioritized for cost reduction efforts. In this example, management first focused their attention on the cutting activity because it was the largest cost component of the cost object. However, the testing activity proved to be the most important activity to manage. This is because it was deemed non-value-added, and represented the second largest cost in the bill of activities.

Cost drivers serve as a practical measure for the rate at which activities consume resources. Changes to processes and activities can be examined and monitored by focusing on cost driver transactions (Cooper 1989a, Dolinsky and Vollmann 1991). For example, AT&T (Hobdy et al. 1994) used cost driver analysis to identify operational cost improvements and to quantify savings from proposed initiatives. If the largest contributor to cost is determined to be the activity of setting up machines and the cost driver is identified as the number of batches, then management can focus the cost reduction effort by attempting to reduce the number of batches in the production process.

However, Miller and Vollmann (1985) and Turney (1992) suggests that cost reduction efforts should incorporate the relative value of each activity in the analysis. The activities which consume the most resources and provide the least value should be targeted first. Figure 6.2 below illustrates the relationship between value and cost in cost reduction analysis:



(Figure 6.2) (Turney 1992)

Activities which belong in quadrant one possess the highest value and the least amount of cost. These activities should represent the lowest priority for cost reduction efforts. In contrast, those activities which belong in quadrant four should be the first activities targeted for cost reduction or elimination.

6.3.4 ABM and budgeting. The cost reduction aspects of activity analysis can be extended to budget planning. Brimson and Fraser (1991) first introduced the idea of using activity information in the budgeting process. Activity resource requirements can be expressed both in monetary terms and in cost driver transaction terms. Combining these aspects of resource consumption gives a more complete view of cost behaviour for budgeting purposes. For example, a budget figure of £25,000 may be set at the beginning of the fiscal year for the activity of managing customer queries. The monetary figure is based on expected cost driver transactions of 5,000 queries. If cost variances result, the number of cost driver transactions could be examined to determine if the increase, or decrease, in expense is justified with respect to the changes in the volume of work. A standard productivity measure could be established based on the expected costs per unit of cost driver. For example, the standard cost for managing customer queries would be £5 (£25,000/5000) per customer query. If the cost of the resources consumed by the activity increases and the number of cost driver occurrences stays the same or declines, this may be an indication that productivity has been reduced.

Traditional budget variance analysis could be constructed using activity-based information. However, in contrast to traditional approaches, activity-based budgeting (ABB) gives added visibility to the cost variance and provides a more constructive signal for investigation. Visibility is enhanced by showing how overhead resources are used (Yoshikawa et al. 1993). The variance is segmented by activities which can also be broken down into spending and usage variances. For example, consider the example above of managing customer queries. The variances for this activity are shown in figure 6.3 below:

```
    MANAGING QUERIES VARIANCE ANALYSIS

COST INFORMATION:
 (SR) STANDARD RATE (£25,000/5000) = £5 PER QUERY
 (SQ) STANDARD USAGE = 5000 QUERIES
 BUDGETED COST = £25,000
 (AQ) ACTUAL USAGE = 4,000 QUERIES
 ACTUAL COST = £28,000
 (AR) ACTUAL RATE (£28,000/4000) = £7 PER QUERY


SPENDING VARIANCE: (AQ X (SR - AR))

    4000 X (£5 - £7) = £8,000 UNFAVOURABLE


USAGE VARIANCE: ((SR X (SQ - AQ))

    £5 X (5000 - 4000) = £5,000  UNFAVOURABLE
```

(Figure 6.3)

The usage variance indicates the level of capacity at which the activity is operating (Yoshikawa et al 1993). The activity-based usage variance indicates that, for the period under examination, the activity of managing queries is at 80% (4000/5000) of capacity. However, in terms of resources, the level of resource consumption is in excess of capacity by 112% (£28,000/£25,000). This analysis indicates a reduction in the level of productivity for this activity by 40% ((£7-£5)/£5). Therefore, an investigation of why the standard is not being achieved should be undertaken.

Kaplan (1994a) warns that the assignment of capacity to an activity is much more complex than simply determining the expected cost and driver levels. Activities are composed of a myriad of resource expense categories. The activity may have both committed and flexible resources traced to it. Flexible resources are supplied only as needed, and no unused capacity exists. In contrast, committed resources are supplied in advance of usage and consequently result in excess capacity. The committed resource portion should have a different cost driver and level of capacity than the flexible portion of the activity cost. The flexible cost driver depicts the rate of resource consumption in direct proportion to resource spending. In contrast, the cost driver used for the committed cost portion of the activity cost will exhibit an indirect relationship between usage and spending. Kaplan (1994a) suggest that this two tier approach to budgeting be used to properly apply ABB concepts. For example, manufacturing equipment and factory floor space may be dedicated to the activity of inspections. In this case, two different cost drivers are required to assign resource expenses to cost objects. The committed expenses (equipment and space) are assigned, based on the capacity or expected capabilities provided by these resources, while the expenses of the flexible resources (inspectors) are assigned, based on the activity volumes actually realized. This procedure is consistent with the traditional approach of using actual demand for variable (flexible) resources and anticipated demand for fixed (committed) resources. Mak and Roush (1994) propose further modifications to ABB. In addition to separating activity cost components into flexible and committed cost, excess capacity variables can be used to calculate efficiency variances. The cost driver is thus split into two different dimensions, one depicting the relationship between flexible costs, and the other representing the level of excess capacity.

6.3.5 ABM and Life-cycle costing. Life cycle cost analysis focuses upon all the stages of a product or service. A pre-introductory stage, an introduction stage, a growth stage, a maturity stage, and a decline stage represent the standard view of the life of a product (Burch 1994). Generally accepted accounting practices focus on short fiscal periods to determine net income at conveniently segmented intervals. This form of measurement is inconsistent with the way in which products are developed, produced, marketed, and distributed, as a product's life cycle normally extends over a number of accounting periods. Development costs are incurred upfront even before any revenues are gained. Indeed, Berliner and Brimson (1988) suggest that as much as 90% of the life-cycle costs of a new product or service are committed during the development stage. Life-cycle costing is a departure from accepted accrual accounting measures, and focuses on the cost of the product over its entire life. Using activity information, resources are more accurately matched to products over the five stages of the life-cycle. Overhead costs, which are traditionally allocated to products over short fiscal periods, only serve to distort product costs (Johnson 1988). By tracing activity costs to products over the entire life-cycle, the complex composition of overhead costs is visualized for management to evaluate properly the relevant costs associated with a product or service. For example, it is misleading to compare two different product lines at different stages of the life-cycle. This is because new products require more cost in the early stages of development. Traditional accounting allocation measures would tend to overstate the cost for new products and understate the cost for mature products (Kaplan 1988).

Life-cycle costing and ABM work together to highlight the cost throughout a product's life (Wasson 1974). Activities, and the associated consumption of resources, must be outlined along the life-cycle stage continuum. For example, engineering and design activities are likely to be incurred in the early stages of a product's life. In addition, life-cycle information can help identify which activities can be improved, and show when cost changes can be expected.

6.3.6 ABM and Target costing. Target costing is a management approach for reducing the cost of a product or service by employing specification and design procedures at the earliest stage and the lowest possible cost (Monden and Hamada 1991). In contrast to traditional costing practices, target costs are determined in advance of new product development rather than at the design and production stage. The target cost is determined by considering the expected market price and the desired rate of return. Sakurai (1989) argues that the goal is to develop a product or service to meet the target cost throughout the product's life-cycle. Traditionally, ideas on product designs have started in the engineering department and costs are calculated as an "after thought" as the product design moves into the production stage (Yoshikawa et al. 1994). With target costing, marketing first defines the target cost and price mix by assessing the market environment then product designs are made to conform to the target cost (Sakurai 1989). Engineering and design concepts are balanced with cost targets as an integral part of product development (Tanaka 1993).

According to Jonez and Wright (1987), activity information supports this process by providing a framework for estimating the impact of design decisions on product cost. Cost drivers can serve as a link between engineering decisions, activities, and the market environment. For example, Hewlett-Packard (Cooper 1989b) used ABM to build a product design which contained a bill of activities which met the cost target. Various alternative product designs were introduced and filtered through the ABC system, using cost drivers to determine the impact of design changes on costs. For example, if a certain design change required an increased number of cost driver transactions to perform an activity, the cost could be calculated by multiplying the cost driver unit cost by the number of expected transactions. Thus design actions, which may have lacked quantifiable cost measures in the past, could now be used to determine their impact on product costs.

6.4 ABM AND BUSINESS PROCESS RE-ENGINEERING

A business process is a sequence of coordinated activities which are directed at a common objective (Greenwood and Reeve 1994). Re-engineering is a management technique which attempts to dramatically reconstruct the business process to increase efficiency, speed, and quality (Hammer and Champy 1993). ABM provides the financial metrics, including value-added content and cost of quality, to support the re-engineering process (McCloud 1993). Linking products to processes and then back to resources provides the understanding necessary for management to reshape the current process (Greenwood and Reeve 1994). Activity cost components are summarized to add a cost dimension description to the process, while cost drivers are used to analyze the consumption of resources through the process (Brinker 1993). Burch (1994) suggests the use of a process flow diagram combining the cost and usage dimension to help management visualize the "as is" process. Activity mapping, described by Morrow and Hazell (1992), augments business process re-engineering by incorporating the cross functionality of process interaction. The theory is that each activity consumes inputs, and converts this to some output. The output of the activity provides the input to another activity. The composition of activity outputs are designed to produce a process-output. Activity maps record work flows on a two dimensional graph, incorporating both time and location to reveal process complexity, and to help management understand the linkages between activities, process, and functional areas (more about activity maps is presented in the following chapter).

6.5 ABM AND PERFORMANCE MEASUREMENT

Traditional performance measurement focuses primarily on financial indicators such as net income and return on investments. Johnson and Kaplan (1987a) argue that over the last decade there has been a growing managerial dissatisfaction with these traditional performance measures. Indeed, Howell's et al. (1987) survey results revealed that 60% of chief financial officers in manufacturing firms indicated that existing performance measures were inadequate. Financial performance measures alone do not meet the criteria of effective managerial control of "completeness" identified by Emmanuel et al. (1990).

Although a composition of financial indicators may give a partial picture of the company's overall health, non-financial measures may provide a supplementary enhancement which overcomes some of the problems of the financial measures (Kaplan 1983). Activity information is one other way in which conventional reporting can be modified. Activities in the organization comprise the behaviour of the organization. How an organization behaves defines the level of performance achieved. Non-financial indicators need to be linked to financial ones to give management a complete picture of organizational performance.

Kaplan and Norton (1992) suggest a "balanced scorecard" approach to performance measurement. A balanced scorecard is a summary of a composition of various aspects of financial and non-financial indicators. This composition of indicators is designed to give management a complete understanding of a firm's performance. Kaplan (1994b) outlines four categories of performance:

> 1. Financial. How do we create value for shareholders?
> 2. Customer. What do existing and new customers value from us?
> 3. Internal. What processes must we excel at to achieve our financial and customer objectives?
> 4. Innovation. Can we continue to improve and create future value?

ABM facilitates the development and use of non-financial indicators by identifying quantifiable measures of output for operational work and effort (Ward and Ketan 1990, Kaplan and Norton 1993). Cost driver transactions can be objectively collected, tracked, and monitored to show where effort is being expanded, where effort is lacking, and where potential waste is occurring (Yoshikawa et al. 1993).

6.6 EXTENSIONS OF ABC

ABC has evolved into a pervasive cost management tool and, in addition to its use in manufacturing firms, has proved applicable in other business sectors, such as professional firms, and service and distribution companies (Sephton and Ward 1990, Rotch 1990, Brignall et al. 1991, Bussey 1993). As described earlier, its use extends into such areas as cost reduction, budgeting (Brimson and Fraser 1991), customer analysis (Bellis-Jones 1989, Kaplan 1994a), product design considerations (Jonez and Wright 1987, Dolinsky and

Vollmann 1991, Foster and Mahendra 1994), and performance measurement (Steimer 1990, Carlson & Young 1993). The pervasiveness of ABC has thus contributed to its significant profile in modern management accounting practice. This is evidenced by the use of ABC in three key areas of management accounting; inventory valuation, decision support, and cost control.

6.6.1 Inventory valuation. It has been suggested by Johnson and Kaplan (1987a) that management accounting has long been subservient to the dictates of financial reporting requirements with regard to inventory measurement (Johnson and Kaplan 1987a, Johnson 1988). External reporting is designed to meet statutory and professional requirements, and to satisfy the needs of creditors, investors, and stockholders. Therefore, its influence on the relevance of managerial information is dubious. Given the technology constraints of the past, only a single basic reporting system for profitability was practical. Consequently, the internal reporting needs of management were subjugated to external reporting demands, and in the quest for unbiased and standardized external reporting, much of its utility was compromised.

Financial reporting standards dictate that a portion of fixed production costs should be included with direct costs to comprise the value of inventory. The basis for this policy stems from the conceptual accounting definition of an asset. This is typified by Horngren's (1972) definition. "An asset is an expenditure which is expected to provide economic benefit in future periods". Consequently, as inventory is an asset, all costs which are traceable to its production represent the criteria of future benefit and should be included in the valuation. Because many fixed costs can not be traced directly to products, a fully absorbed inventory value requires the use of what are often arbitrary allocation methods to unitize fixed costs. This sort of arbitrary allocation of fixed cost results in a number of product costs distortions (Johnson and Kaplan 1987b, Shank and Govindarajan 1988, Roth and Borthick 1991), and to extend the use of these costs beyond inventory valuation can be misleading. In contrast, variable costing proponents endorse an approach which attaches only variable costs to the product and considers fixed costs as period costs to be charged to profit as incurred. Although full absorption costing remains the standard for external reporting, profit reports incorporating the variable cost approach can be adopted for internal use (Mowen 1986). For example, it can support the contribution margin analysis of individual products and organizational segments.

ABC can enrich this debate by offering a means of determining more accurately the extent to which indirect costs become inventoriable assets (Mitchell 1994a). ABC does this in two ways. First, by bridging the gap between the variable and fixed dichotomy. Second, by enhancing the understanding of future economic benefits (Innes and Mitchell 1990a). ABC bridges the theoretical gap between full absorption and variable costing advocates. Cooper (1990a) identifies at least three more allocation bases, other than unit volume, by which cost variability can occur. They are batch, product, and facility related costs. Each hierarchical level is variable in proportion to a different class of cost driver. The ABC concept expands and redefines the definition of "variable cost" to mean cost variation with respect to a range of cost drivers. The application of cost hierarchies brings visibility to the behaviour of the components of overhead costs, and refines the traceability of inventoriable costs (Mitchell 1994b).

If a cost is both traceable to inventory and provides future economic benefit, it should be inventoried according to generally accepted accounting practices. In contrast, a cost which is not expected to provide future benefit should be considered a period cost (Burch 1994). Such is the case with the spoilage and wastage content of production costs and they are thus excluded from the valuation of inventory. ABC analysis raises an interesting problem on the issue of inventory valuation. Activity attributes are used in ABC systems to identify those activity costs which do not add value to the product. In a sense, non-value-added activity costs are similar to spoiled production costs as by definition they do not contribute to the generation of future revenue from customers. Thus Mitchell (1994a) argues that to be consistent with established accounting practices, non-value-added costs should be excluded from the computation of inventoriable production costs. However, applying ABC concepts to inventory valuation does not solve many of the limitations of the traditional approach. Many shared product costs will continue to require a level of arbitrary allocation, and classifying costs into a single cost hierarchy is often problematic and somewhat arbitrary in practice (Cobb et al. 1992). Finally, assessing the extent to which an activity contributes value to the firm remains a highly subjective process.

6.6.2 Decision support. ABC systems add support to decision making in two ways. First, they enhance the capacity of management to predict indirect overhead cost behaviour (Christensen and Sharp 1993, Mackey and Hughes 1993). Second, they permit the incorporation of qualitative variables into decision models (Turney 1992).

The use of relevant cost information for product related decisions, such as make-or-buy and drop-or-add, is dependent on the identification of incremental costs (Arnold and Hope 1983, Luther 1992, Theeuwes and Adriaansen 1994). The traditional view of incremental costs encompasses those costs which are directly traceable to the product and possess a positive linear correlation with production volume (Noreen 1991). Horngren (1990) argues that traditional notions of incremental costs restrict its correlation requirement to production volume alone and consequently limit cost predictability. This is because there may be other approximate linear relationships which could be modeled to predict cost behaviour.

ABC uses cost drivers to approximate the rate of resource consumption (Kaplan 1994b).

Cooper (1990c) argues that the diversity and complexity of the production process can be more accurately represented by considering other resource consumption relationships in addition to production volume. However, Carlson and Young (1993) warn that using multiple cost variation bases adds considerable complexity to cost system design and interpretation as well. In addition, Dopuch (1993) warns that the use of multiple cost drivers may not be necessary for improvements in managerial decisions. Babad and Balachandran (1993) suggest that the increase in accuracy gained by using multiple cost drivers has to be balanced against increases in information processing costs.

The problem with using cost driver analysis is that there are many interrelated influences on cost behaviour, and no one causal link could capture this relationship. Datar et al. (1993) offer a model to estimate the interdependencies among activities. They suggest the use of process design variables rather than transaction variables as a cost driver to express the interconnected relationship among activities. Finally, in an empirical study of the U.S. airline industry, Banker and Johnson (1993) argue that many firms have employed operational cost drivers on the basis of this perceived need for more accurate cost estimates, and have designed and implemented ABC (Schiff 1991). However, from an academic perspective, the case for using cost drivers to improve accuracy is far from complete. In contrast to Foster and Gupta's (1990) findings, which leave the impression that systems based on just volume may not significantly distort information generated for managerial decisions, Banker and Johnson's (1993) empirical evidence supports the incorporation of operation-based cost drivers to improve accuracy and productivity.

By employing activity attributes, important non-financial data may be included in the decision making process (Brimson 1991, Walker 1991). Attributes such as value/non-value added, necessary/unnecessary, and controllable/non-controllable could be incorporated into decision models such as the contribution margin approach (Cooper and Kaplan 1992a) (see

Chapter 7 for a discussion of ABC and the contribution margin approach). However, defining activity attributes is highly subjective and this does limit the accuracy of the resultant analysis (Sharp and Christensen 1991).

6.6.3 Cost control. Cost management systems are intended to provide information to help managers control, monitor, and influence the behaviour of the organizational participants. Management uses performance measurement and reward systems to motivate employees to perform activities consistent with organizational goals (Emmanuel et al. 1990).

ABC strengthens the monitoring and performance measurement capacity of management by making visible the complex nature of overhead costs (Miller and Vollman 1985). It provides an understandable framework which assists in the identification of the causes of costs. By understanding how costs are caused, management is in a much better position to control them by managing these causes (Drury 1989).

Performance measures are the link to monitoring the effectiveness of cost control efforts. Cost drivers add a new dimension to the budgeting process by providing both a cost measure and a transaction rate upon which to base budgets (Brimson 1988a). Not only can the monetary value of activity costs be monitored, but the rate at which the activity consumes resources can be monitored in terms of the number of cost driver transactions incurred (Mak and Roush 1994). Cost driver transactions and activity costs can be compared to predetermined budget figures as a measure of performance for cost control (Kaplan 1994a).

Friedman and Lyne (1995) suggest that using cost drivers and activity costs in the budgeting process also provides a cross functional system for interdepartmental feedback. Activities often cross functional lines incorporating responsibility from managers in several departments. Rather than focusing on how much cost belongs to which department, managers are forced to attack the problem from a process view (Greenwood and Reeve 1994). In an ABC environment managers are more likely to work together exchanging information about how costs from one department affect costs in another (Cooper and Kaplan 1991b). Communication is enhanced by the recognition of the natural inter-departmental dependency which exists in the organizational environment.

Although communication and feedback may be increased by ABC and ABB, Johnson (1992) argues that accountability for departmental cost can become impaired. The process view spreads the responsibility for budget accountability over a wider group of personnel. Therefore, establishing a clear line of responsibility becomes more problematic.

6.7 ABC IN THE SERVICE INDUSTRY

The development of output costing and cost management techniques in the service sector has traditionally lagged behind manufacturing firms (Banker and Johnson 1988, Sephton and Ward 1990, Johnson et al. 1990). In a survey conducted by Innes and Mitchell (1995) respondents indicated that ABC was now also becoming popular in the service industry. Since service organizations (e.g: banks and professional firms) are likely to have a higher proportion of overhead costs, ABC is even more suitable for these types of industries (Romano 1988, Anotos 1992, Lewis 1993).

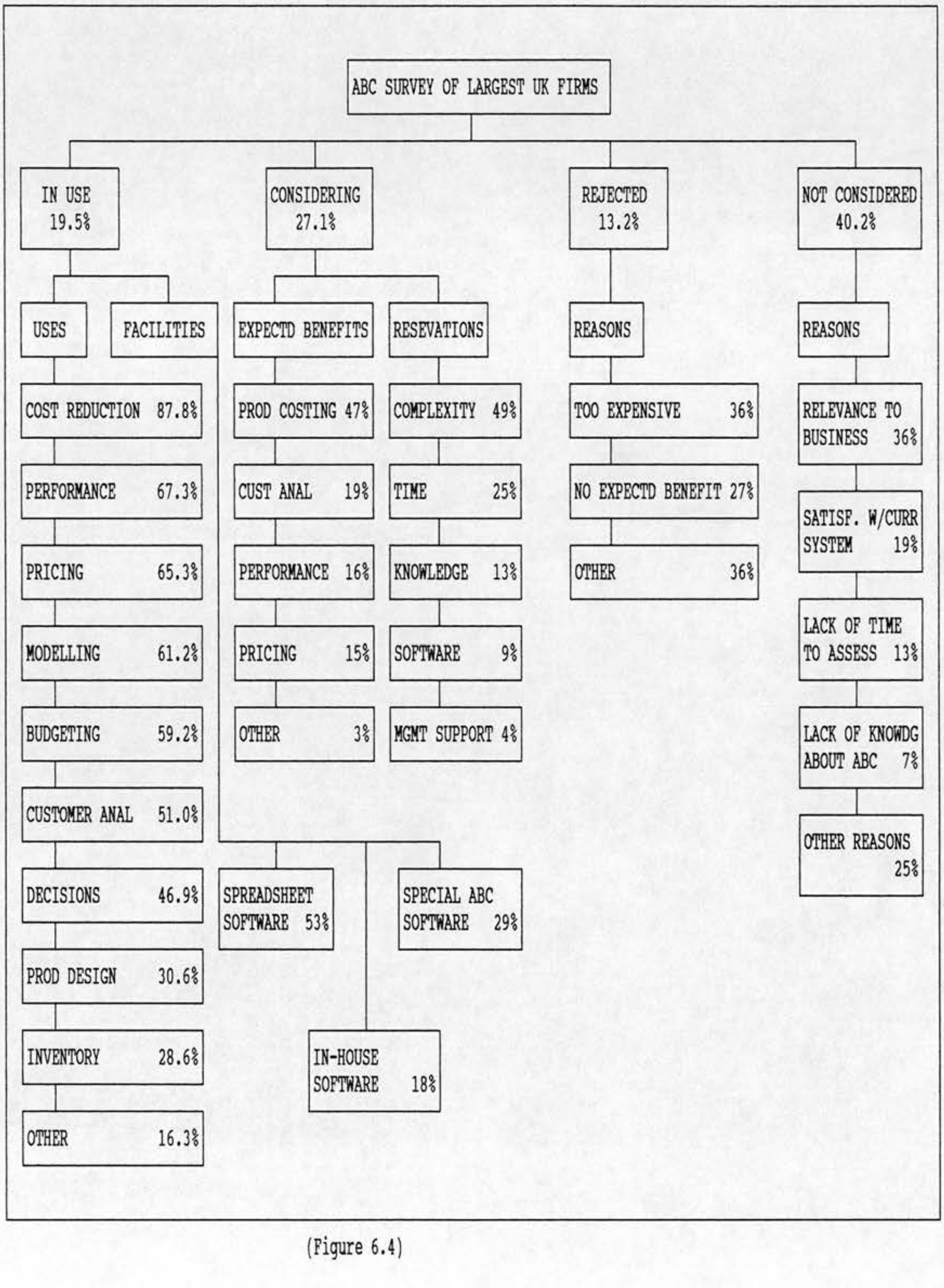
There are a number of case studies and publications which illustrate the application of ABC in the service sector (Ramono 1988). For example, Bussey (1993) shows how British Telecom incorporated ABC concepts prior to ABC becoming popularized. Burch (1994) incorporates explanations about the rail-road industry and hospitals' application of ABC. Brignall et al. (1991) analyze the output of five service organizations with respect to competitive advantage gained from using ABC. Further examples of service sector applications have been identified in an ABC survey by Innes and Mitchell (1991a).

6.8 A BROADER VIEW OF ABC

As indicated above, ABC has the potential for pervasive influence in modern day management accounting. Although there have been a number of case study research into the operational and organizational implications of ABC, little research has been directed towards the way in which ABC is accepted and used among the broad population of companies (Johnson 1987, Cooper 1988b, Cooper and Kaplan 1991b, Brimson 1991, Bhimani and Pigott 1992a). Against the background of ABC's wide range of applications, Innes and Mitchell (1995) have conducted a survey of the largest companies in the United Kingdom. Several years earlier Innes and Mitchell (1991a) conducted a similar study which now invites comparison for trend analysis. In addition, although not addressing ABC exclusively, Drury et al. (1993) conducted a survey to study management accounting techniques in the manufacturing sectors. Other survey studies which exclusively focus on ABC include Armatage's (1993) survey of Canadian practices, and Ask and Ax's (1992) survey of the Swedish manufacturing industry.

Innes and Mitchell's (1995) survey of the largest UK companies reveals that ABC is used and applied in many areas of management accounting including pricing, decision making, cost reduction, budgeting, product design, customer profitability analysis, and performance measurement. The results indicate that ABC is currently used in a significant number of companies in the UK, and is being assessed in many more. Comparing some of the data of the latest Innes and Mitchell survey with the earlier version indicates a significant increase in the number of firms using and considering ABC.

According to Innes and Mitchell's (1995) survey, almost 20% of the companies surveyed were reported to be using some form of ABC, while another 27% were in the process of considering it. Over half of the companies either had rejected using ABC or had never considered it. Most of the respondents who used ABC reported applying it primarily towards cost reduction efforts and performance measurement. Key aspects of the 1994 survey results can be summarized in the following flow-chart in figure 6.4:



(Figure 6.4)

Relating to the companies considering the implementation of ABC, the survey results indicate that the most significant expected benefit of adopting ABC was its ability to make costs visible which would assist in controlling overhead costs. The firms rejecting the use of ABC emphasized the high costs associated with implementing and maintaining the system. Other reasons included satisfaction with the current cost management system and a lack of perceived benefits from ABC.

A significant number of firms had not considered using ABC. The predominant reason for this was the perceived lack of suitability of an ABC system for their particular type of business. The survey reveals that ABC was widely more used and accepted among the larger firms, particularly in manufacturing type organizations. The firms that showed the least inclination to adopt ABC were the service type, and large construction-oriented companies.

6.9 CONCLUSION

Using activity information to manage costs adds a new and interesting dimension to management and management accounting. The applications of ABM demonstrate that it is a significant and pervasive influence on cost management, and has the potential to contribute to a wide range of management decision making problems. With ABM, activity data is not only used to calculate accurate products costs, but also to add visibility to the operational domain. Operational visibility is what most management information systems are designed to achieve. It may be argued that ABC and ABM are simply new management accounting techniques. However, given the pervasive influence ABM has on general management, it may more appropriately be considered a management philosophy rather than a specific procedure to solve a specific problem.

ABM can provide guidance for managers at the operational level, at the tactical level, and at the strategic level (Yoshikawa et al. 1993). In contrast to the operational and tactical benefits that ABM purports to deliver, controversy surrounds the strategic applications of ABM. For example, Goldratt (Jayson 1987) argues that cost accounting and especially ABC are the "number one enemy of productivity". In addition, Johnson (1992) suggests that cost control and reporting are not effective for improving process controls and efficiency. Indeed, Hopwood (1994) puts forward the argument that knowing the cost of things is not necessary for making improvements and increasing productivity. Despite these criticisms, ABM has surfaced as a influential addition to the practice of management accounting. However, these criticisms underscore the fact that activity accounting and its potential benefits should not be viewed as "revolutionary", but rather as "evolutionary" (Bromwich and Bhimani 1989).

ABC has emerged as a methodology which can be integrated into many established approaches to cost management, such as decisions analysis, budgeting, and performance measures. Johnson and Kaplan (1987a) highlighted the distortions which can result from applying traditional methods, and paved the way for academics and professionals to consider alternate approaches. The dissatisfaction with current costing techniques has advanced the role of ABM in modern management accounting, and has added to the interest in and consideration of ABC by both manufacturing and service sector companies. This is evidenced by the growing consultancy services, and the large number of conferences which specialize in the implementation of ABC, as well as the increase in the number of publications in academic and professional journals. The Innes and Mitchell (1995) results support this by suggesting an increase in the number of companies actually using ABM as well as those considering it.

The following chapter expands on the applications of ABM discussed here by developing two decision models which can be constructed, using activity information, to solve specific business problems. The first model uses ABC attributes to incorporate important qualitative data into a typical contribution margin analysis. The second model suggests the use of activity maps to link both ABC and the Theory of Constraints (TOC) together (Salafatinos 1995).

CHAPTER SEVEN

ISSUES DERIVING FROM ACTIVITY-BASED COSTING APPLICATION

This chapter is divided into two sections. The first section is devoted to an analysis of how activity information can be used to expand the traditional contribution margin model. It suggests that a modified model can be constructed using ABC attributes, such as controllability, to improve decision making. In section two, activity maps are used to provide a link between the Theory of Constraints (TOC) and aspects of ABC.

SECTION ONE:

THE POWER OF ATTRIBUTES AND COST HIERARCHIES:

A CONTRIBUTION MARGIN APPROACH

7.1 INTRODUCTION

Activity-based costing (ABC) concepts can enhance the application of the contribution margin approach in two critical ways. They first expand the notion of cost variability and second, permit the efficient incorporation of qualitative variables. Both aspects serve to improve cost predictability and thus extend the usefulness of contribution margin analysis in short term decision making.

Section 1 of Chapter 7 first examines the major cost based limitations of traditional contribution margin analysis. It then explains how introducing ABC concepts of cost variability and qualitative coding schemes into a typical make-buy decision model can enhance the accountancy information available to the decision maker. These benefits are obtained by focusing on the qualitative variable of management's control over cost behaviour, and the usefulness of multiple cost variation hierarchies such as the unit-level, batch-level, product-level, and facility level structure suggested by Cooper and Kaplan (1992a).

7.2 PROBLEMS WITH THE TRADITIONAL CONTRIBUTION MARGIN

The main problem with the traditional contribution margin approach is its simplistic view of cost variability and therefore its inability to capture complex qualitative aspects embedded in the economic environment (Kaplan 1984). The traditional model relies extensively on establishing incremental costs with linear relationships to one factor, production volume. However, constraints placed on management control may inhibit the incremental effect of direct costs and limit the linear relationship with production volume.

7.2.1 Management control. All costs are subject to management action (Christensen and Sharp 1993). The degree by which management is able to control direct incremental costs, such as labour and materials, determines the extent to which these costs, may be considered to vary directly with production volume. If management influence is weak, then the linear incremental effect will not necessarily occur. Costs categorized as direct, indirect, variable, or fixed are all subject to varying degrees of constraint, which impinges on managerial control even in the short-term. For example, changes in direct labour may be restricted by labour contracts prohibiting immediate cost reductions through employee terminations. If a specific product is discontinued, direct labour has been eliminated from that product as a direct cost, in an accounting sense. However, total labour costs have remained constant because no workers have been terminated (Mitchell and Wycherley 1994). It may be a number of months or even years before total labour costs reductions fully respond to production changes.

With extensive inventory of raw materials, even direct material cost may not respond in an incremental manner at first. Real material cost reductions may not be realized immediately in response to production reductions. Total material costs may continue for some time when stocks are depleted or sold off as scrap. In the interim, current material costs of handling, storage, and supplier contract constraint costs continue to be incurred even though they may not be formally recognized by the accounting system as direct material costs. It is likely that direct materials would increment with production volume more than any other cost classification, but managerial constraints may disrupt this pattern or at least delay it.

The variable overhead portion of incremental costs is less likely to behave in an incremental pattern with production volume. The concept of cost variability changes depending on the time span chosen for the analysis (Yoshikawa et al. 1993). In the short-term, accountants used the simplistic fixed/variable dichotomy to represent cost behaviour. Often overhead costs which are traditionally known as variable may be fixed in relation to volume. The traditional approach tends to lump incremental costs and direct costs together. Just because a cost can be reasonably assigned to a unit of product does not necessarily mean that it will behave in an incremental manner with respect to production volume.

7.2.2 Cost variability. The traditional contribution margin approach only considers cost variation based on unit volume (Belkaoui 1991). It assumes that cost behaviour can only be explained fully by variations in production volume. All costs that do not correlate with volume fluctuations must be constant, fixed, and unchanging in the short-term (Burch 1994). This is a dangerous assumption because it is a simplification, and frequently a distortion, of the reality of cost behaviour. It can distract management's attention from trying to manage and control overhead costs. ABC has highlighted the potential distortions which may occur when using a single unit-level variation base. The notion that a cost is only variable if it correlates positively to changes in production volume provides a limited perspective of cost variability.

7.3 ABC'S "CONTRIBUTION"

The ABC approach to cost behaviour assumes that not all variable costs are consumed in direct proportion to the number of units produced. It recognizes that cost behaviour is much more complex and fluctuates in response to factors other than production volume. Product complexity, variety, flexibility, quality and service factors can all influence costs significantly. Cost drivers can be used to predict and measure how resources are consumed by the various dimensions of work performance. Drivers may include a variety of work measures including for example, number of purchase orders, machine hours, number of set-ups, or number of customer orders (Cooper and Kaplan 1992a). Cost drivers can be categorized into four different categories of cost variation: unit-based, batch-based, product-based, and facility-based (Cooper 1990a). This hierarchy of cost variation bases is designed to capture some of the complex economic reality of cost behaviour. In order for costs to be properly categorized to a variation base, the nature of the cost must be understood. This can be accomplished through activity analysis, which is the main theme of ABC.

One of the most significant insights of ABC is that greater understanding of cost behaviour may be found through determining what factors cause work to be performed. Cost elements contained within the general ledger are based on resource supply categories (Cooper and Kaplan 1991b). ABC systems are designed to help managers look beyond resource supply to understand how resources are consumed through activities (Cokins et al. 1993). General ledger cost elements provide a vertical view of cost content. That is, costs can only be examined within the functional area where the resource has been targeted. In contrast, ABC slices horizontally through the organization allowing a view of the company that crosses functional and divisional boundaries. This view is obtained by focusing on work processes, rather than on accounting classifications which are designed for record keeping and financial reporting.

ABC is often characterized as a long-term decision making model because it tends to focus on processes and strategic decision making (Shank and Govindarajan 1992). In fact, the

ABC model is based on the premise that all costs, given an appropriate time horizon and cost driver, are variable (Dugdale 1990). However, ABC concepts can also be used for short-term decision making. This is because ABC enhances the predictability of variable costs and possesses the capacity to add qualitative variables, reflecting a more complex reality. Variable costs in an ABC model are those costs which increment with respect to a given cost driver. ABC also demonstrates how costs may vary proportionately with a hierarchy of cost variation levels which include unit, batch, product, and facility levels.

7.3.1 Cost hierarchies. ABC assumes that resources are consumed by activities and the manner in which activities consume costs determines the basis of cost variability. Unit level activity costs are those which would approximately increment with the volume of units produced. An activity such as drilling holes on each part would be considered a unit-level activity cost because it is likely to vary proportionately with production volume. Batch-level variation occurs with such activities as setting up machines or ordering a group of parts for a production run. These costs are relatively independent of the number of units produced, but increment with respect to the number of batches. Product-sustaining activity costs are performed to support different product lines. Maintaining product specifications, performing engineering changes, and expediting products are all examples of product sustaining activity costs. These costs can be assigned to product lines or groups, but they are relatively fixed in relation to production volume or number of batches. Product level costs can be incurred even if no unit production occurs at all.

Unit, batch, and production-sustaining activity costs may be reasonably assigned to individual products[1], facility-sustaining costs however, enable production to occur but tend to be independent of product volume and mix in the short-term. General insurance, accounting services, and general administration are examples of facility-sustaining costs. These costs could be classified as fixed with respect to all of the other variation bases. Cost variation of facility based costs will occur with respect to changes in the facility of the organization.

With ABC, all costs are considered to have potential variation within this cost hierarchy. Costs within one hierarchical level are likely to be fixed with respect to another level. It is assumed, however, that all costs within a specific hierarchical level will vary approximately in proportion to that level's activity cost driver. The ABC hierarchy can be summarized as follows:

1. <u>Unit-based.</u> Cost variation occurs in proportion to production volume.
2. <u>Batch-based.</u> Cost variation occurs in proportion to the number of batches in the production process.
3. <u>Product-based.</u> Cost variation occurs in proportion to product type changes, like design changes.
4. <u>Facility-based.</u> Cost variation occurs in proportion to changes in the general facility. These cost are generally considered fixed, and only change if facility adjustments are made.

This hierarchical approach to cost variation is intended to provide an extension to the traditional highly simplistic fixed/variable categorization. It is not intended to provide managers with an absolute statistical correlation by which to calculate changes in costs, but rather a more realistic estimate by which to predict the outcome of managerial decisions and cost levels. Models are summarizations and simplifications of a complex and dynamic

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[1] According to Cooper (1990) activity costs and their drivers can be assigned a single cost hierarchy classification. In practice, however, forcing activities into a single hierarchy may be impractical. It may be that certain activities possess multiple characteristics of cost variation patterns. An activity cost might be divided up into unit, batch, product and facility level components. More research is needed in this area.

world. All that managers can reasonably expect from a model, such as the contribution margin, is an organized and systematic approach, managing information to help approximate probable outcomes of decisions.

Clearly, managers could invest large amounts of time and energy in studying each particular decision problem, with the aim of accumulating all the relevant information and deriving a close approximation of the effects of a decision (Merchant and Shields 1993). If this is done, no routine model, such as the contribution margin, or even an expanded ABC version, may be needed at all. This method may be appropriate for large scale projects requiring long-term investment and capital considerations. However, it is inappropriate and impractical for short-term decisions which requires speed and low cost implementation. The manager must always balance the cost of accuracy with the benefits expected from the information. While a systematic approach is not always appropriate to decision problems, it can be faster, more efficient, and less expensive than an in-depth study. Moreover, outcomes from an in-depth study may not be materially different from a systematic decision model. This makes the contribution margin an attractive tool for making short-term decisions. Any additions to the model must also be efficient and systematic in order to continue its cost effectiveness and timeliness. ABC systems provide the increase of complexity to compliment the contribution approach without sacrificing much of the simplicity and routine applicability of the model. Indeed, through attribute coding and other refinements, ABC systems can incorporate qualitative variables into the decision making process in a systematic and efficient manner (Sharp and Christensen 1991).

7.3.2 Attribute coding schemes. ABC can utilize coding schemes to turn qualitative attributes about cost information into manageable data that can be included in a decision making model (Walker 1991). Attributes are descriptive labels given to activity costs which provide an orderly way of categorizing qualitative variables. In the past, limited technology precluded the efficient incorporation of qualitative data on a routine basis (Payne 1992). Collection was unmanageable and therefore it was simply excluded from most cost decision models (Glad 1993). Management accountants were left with unsystematic ad hoc methods to include these variables into the equation. The systematic inclusion of qualitative variables gives the model intelligence (Turney 1992). It provides multiple concurrent views with which to focus, prioritize, analyze, and measure. Coding schemes promote creative ways to associate activities and attributes in a costing context. Commonly used attributes include value-added content and cost-of-quality attributes. The type of attributes identified depends on management's aim.

To summarize, the traditional contribution model ignores important qualitative data such as controllability when considering cost behaviour. It also limits its concept of cost variability to unit based factors. An improved ABC based contribution margin decision model should:

1. Incorporate relevant qualitative factors such as the extent of management control over incremental effect.
2. Provide a reasonable estimate of the probable cost behaviour patterns in terms of cost variation bases.

ABC, through the introduction of coding schemes and multiple variation bases, can satisfy these requirements. Attribute coding allows for the inclusion of qualitative factors which may be relevant to cost behaviour. In addition, an expanded concept of cost variability provides a more accurate prediction of cost consequences of managerial decisions. This expanded view of the contribution margin analysis helps to reduce some of the distortions associated with the traditional model, and thus transforms the model into a better decision-making tool.

7.4 DISTORTIONS WITHIN THE TRADITIONAL MODEL: AN ILLUSTRATION

Distortions in the traditional contribution analysis can be identified in two ways. First, the incremental effect of production volume changes on total direct costs may be less than expected because of various constraints placed on managerial control over those costs. Second, unit based cost variation assumptions may exaggerate the incremental effect of direct costs.

7.4.1 Control distortions. When the effect of management control is not explicitly included in the analysis, there is a possibility it may become hidden in the construction of the model, and the effects may be overlooked. Distortions in the incremental effect of various cost patterns may mislead management and systematically result in less than optimal decisions. These distortions may occur because cost variability patterns do not effectively approximate the economic reality of the situation. This may arise because the traditional contribution margin analysis uses only unit-based variable cost factors and excludes relevant qualitative factors. The following example will illustrate the possible distortions that may occur in typical make-or-buy decision.

Suppose XYZ Company is considering a contract to purchase one of its products instead of continuing to manufacture it. The purchase price for product-X from an outside supplier is £80 per unit. Fixed costs of XYZ Company consist of buildings and equipment needed to produce product-X and other products as well. Since these fixed costs support a number of products, they can not be reduced if the product-X is no longer manufactured. The variable and fixed costs associated with product-X are presented in figure 7.1 below:

Related costs of product X:	
sales price	£100/unit
direct material cost	£ 30/unit
direct labour	£ 45/unit
variable overhead	£ 10/unit
production level	2000 units
total direct labour costs	£90,000
total direct material costs	£60,000
total variable overhead	£20,000
total fixed costs	£40,000
	--------
total costs	£210,000

(figure 7.1)

The decision of whether to make or buy product-X depends upon the difference between relevant cost in both possible alternatives (Luther 1992). The relevant cost would be those costs which would change as a result of the decision. To determine which alternative is less expensive, the total variable costs per unit to make the product must be compared to the cost to purchase it. Total variable costs per unit include direct materials, direct labour, and the variable portion of overhead. If the total variable costs per unit to make the product exceed the cost to purchase it, then it would be more advantageous to accept a contract to buy it instead of manufacturing it. The calculations of the analysis are presented below in figure 7.2:

Contribution margin analysis:		
Purchase price (cost to buy)		£80/unit
Incremental costs to make:		
Direct materials	£30	
Direct labour	£45	
Variable overhead	£10	

Total incremental (cost to make)		£85/unit

Advantage to buy over make		£(5)/unit
		====

(figure 7.2)

According to the traditional contribution margin approach, there is a £5 (£85 - £80) advantage to purchasing the product over manufacturing it. Given the estimated sales volume of product-X of 2000 units, choosing to purchase the product rather than making it would result in an increase in profit of £10,000 (£5 x 2000 units) in the first year. If the direct costs of material, labour, and overhead behave in a manner other than in a positive linear relationship with volume, this estimated profit is unlikely to be realized (Noreen 1991). The degree to which management possesses control over these variables determines the extent to which direct cost will behave in the manner described above.

7.4.2 Control over labour. The above example indicates that it would be more advantageous to elect to buy the product. This is based on the assumption that direct materials, direct labour, and variable overhead costs are completely controllable by management and that control is manifested in immediate cost variation in direct proportion to production volume. If these assumptions are accurate then the decision model gives management an accurate view of the problem. If management has something less than complete control over direct cost, the solution derived from the analysis may result in costly errors. Consider the possibility of constraints placed on management's ability to affect total labour costs. Suppose that XYZ Company's employees are organized by a labour union. Further suppose that conditions in the labour contract prohibit the termination of workers by more than 10% of the total direct labour force per product line in a single year, and then only after a three month notification. Considering the impact of the labour union as a constraint on management control over direct costs makes a significant difference with respect to the buy or make decision in the example above. If direct labour can only be reduced by 10% per year and only for the latter nine months, then the decision to buy the product from an outside supplier comes into question. Under these conditions, much of the labour costs will not change by adopting either alternative. As stated before, only those costs which can be expected to change as a result of the decision should be considered relevant. A make-or-buy analysis considering control constraints on labour is presented in figure 7.3:

Contribution margin analysis considering labour constraint:

Purchase price		£80.0/unit
Incremental costs (to make):		
DM costs	£30.0	
DL costs [(10% x 90,000)/2000] x 9/12]	3.4	
VOH costs	10.0	43.4/unit
Advantage to make over buy		£36.6/unit

(figure 7.3)

One can see from this illustration how control factors influence the outcome in a contribution analysis decision model. Before consideration of labour contract limitations, the make-or-buy decision resulted in a decision to buy product-X rather than make it. After incorporating labour constraints into the model, the decision is reversed indicating to management to make product-X. The author is not suggesting that this (figure 7.3) is the preferred method of incorporating and calculating labour constraints. The point of the illustration is intended only to highlight that traditional incremental costs may change dramatically when the factor of cost controllability is considered. In this example, incremental costs are greatly affected by management's lack of control over direct labour costs. The incremental effect of direct labour costs is much smaller when considering labour contract constraints. Although the accounting system will recognize a reduction of the direct labour cost per unit if this product is no longer produced, the total labour cost remains almost entirely unchanged. According to the labour contract, 90% of the labour costs are contractually fixed in the short-term and therefore should be ignored in the analysis. Moreover, the labour costs which remain behave in an incremental manner for only the last nine months of the first year. Not considering the labour union contract in this analysis may result in a distortion of £83,000 ((£36.6 + £5) x 2000 units) in the first year alone. If the solution to buy the product rather than make it is chosen, as suggested by the first illustration, XYZ Company will lose £73,000 (£36.6 x 2000 units) more than if they continued to make the product. By including labour constraints in the model, an exactly opposite conclusion is reached. Constraints on labour may take various forms, including the company employment policies, government labour law regulations, and worker morale considerations.

7.4.3 Material control. Material costs are perhaps less susceptible to managerial constraints than direct labour. However, certain conditions may limit managerial control over material costs and disrupt the incremental effect often associated with the direct materials. Direct materials are physical objects that attach to and compose a product. These objects are contracted, procured, stored, and processed to construct and add value to a product. The process of direct material management is complex and varied. The process involves many departments from purchasing to receiving, and it affects all aspects of the organization. If management can exercise complete control over the entire material process, from handling and storage to contractual agreements and disposition, then unit-based incremental effects can reasonably be expected. Clearly, when a product is discontinued, the accounting system will recognize the elimination of all direct material costs that are used in the product. The real elimination of direct material cost, however, depends on management's ability to cancel negotiated supplier contracts, store, handle, and remove remaining inventory stock, sell or re-use warehouse space, redeploy, remove or sell machinery, and redirect or eliminate material handling labour elements. In short, the degree by which direct material costs for a specific product can be considered to increment proportionately with unit production depends in part on management ability to control or influence material processes. Some material costs may present management with little constraint over unit-based incrementation. This would be perhaps when the inventory stocks are small, contractual agreements are flexible, and remaining inventory stock can easily be used in another product or sold through the market at fair value. When these qualitative factors are not considered in the model, distortions in the model's predictions may occur because the expected incremental effect of material costs may not be fully realized.

7.4.4 Variable overhead. Variable overhead cost is likely to be the most vulnerable to distortions. There are three reasons for this. First, as explained in previous sections, the conventional method ignores qualitative variables such as controllability and its effect on cost behaviour. Second, variable overhead contains a wide variety of costs and cost behaviour patterns which are not necessarily unit based. Third, so called "fixed costs" may, in fact, be variable when multiple variation bases are considered.

There are a myriad of different cost elements contained in this classification, and just as many possible constraints which would affect the behaviour of these costs. The effect on incrementation from management's control over cost has been adequately illustrated in the previous two sections. Therefore the remainder of this section will be devoted to the distortions which may occur when a unit-based variation concept is employed as a sole means of representing and estimating cost behaviour patterns.

7.4.5 Distortions from unit-level variation bases. As explained earlier, ABC incorporates four possible variation bases in an attempt to represent economic reality more accurately. Because the conventional model uses only unit-based variation, inevitably some costs are lumped into the variable overhead classifications which do not vary with respect to unit volume, while others which have been classified as fixed which do, in fact, vary according to some other variation base. Distortion, therefore, occurs because costs are not examined in the appropriate detail to determine their most probable behaviour pattern. The conventional approach uses cost data in its "raw form". That is, it extracts overhead cost elements directly from the general ledger and classifies them as variable or fixed. Variable overhead costs normally include supplies, power, indirect labour, and other selling and administrative costs that can reasonably approximate a linear proportional relationship with production volume within a relevant range. In this "raw form", costs are very difficult to examine to determine their unique behaviour pattern. ABC allows for costs to be examined in terms of activities to determine the most appropriate cost variation base. Activity costs provide management with a more meaningful understanding of costs behaviour. Using the example of XYZ Company, the conventional view and the ABC view of variable cost information can be compared in figure 7.4 below:

CONVENTIONAL OVERHEAD		(unit)
Variable:		
supplies	£ 2,000	£1
indirect labour	12,000	6
machine power	6,000	3
Fixed:		
building rent	£14,000	
administration	26,000	
Total	£60,000	

ACTIVITY BASED COSTING OVERHEAD		(base)
purchase order processing	£20,000	batch
setting up	5,000	batch
facility maintenance	10,000	facility
expediting	7,000	batch
engineering changes	3,000	product
production testing	12,000	unit
inspecting	3,000	unit
total	£60,000	

(figure 7.4)

One can see from the illustration above that the ABC view of overhead costs does not force cost elements into variable and fixed classifications. It uses a hierarchical approach to cost variability, incorporating the conventionally classified fixed and variable components into this four category framework. Also notice that costs are compiled in activity form rather than raw cost element form. This allows for further examination of cost behaviour and permits the attachment of other qualitative attributes such as cost controllability.

After examining costs in terms of activities, classifying these activities in terms of hierarchical cost variation patterns, and then applying these enhancements to the contribution model, certain distortions become apparent. For example, according to the conventional contribution margin analysis, variable overhead costs are determined to be £20,000 (£2000 + £12000 + £6000) or £10 (£20000 / 2000 units) per unit (see figure 7.4). Variability according to the conventional method means unit- based variation. After examining costs using the ABC approach, it appears that only production testing and inspecting actually vary with units produced. This totals only to £15,000 (£12,000 + £3,000) and translates into £7.5 per unit (£15,000 / 2000 units). This distortion alone would overstate the unit-based incremental costs by £5,000 ((£10 - £7.5) x 2000 units) per year. The make- or-buy decision may change significantly from the original decision. Incorporating ABC unit-based variable costs in the contribution margin analysis is shown in figure 7.5 below:

```
Contribution margin with ABC incremental costs:

 Purchase price                           $80.0/unit

 Incremental costs (cost to make):
   direct materials           £30.0
   direct labour               45.0
   variable overhead (ABC)      7.5        82.5
                                          ------
 advantage to buy or make                 £(2.5)/unit
                                          ======
```

(figure 7.5)

Figure 7.5 illustrates the impact of variable overhead cost changes due to applying ABC concepts to the data. Although the decision to buy the product is still indicated, it is half of the advantage calculated from the original model.

Also consider those activity costs that fall somewhere between the rigid classification of fixed and variable. Purchasing order processing, setting up, and expediting may be fixed in relation to units produced, but may vary in proportion to the number of batches. Engineering changes are, without question, fixed in relation to the number of units produced and the number of batches, but would be expected to vary with respect to the product line and would therefore be a relevant cost to this make-or-buy decision. Traditional fixed expenses such as "rent" would be traced to an activity which would be driven to the facility-level. Assuming that each activity can be assigned a single hierarchy classification, all activity costs driven to this level would be considered fixed with respect to unit, batch, or product-related activity costs.

To accommodate both qualitative aspects, such as controllability, and multiple cost variation bases, a new or modified contribution margin analysis model must be formulated. There are perhaps a number of ways to formulate this new model that are not considered in this chapter. This author has attempted to construct a model that may sufficiently accommodate these new features. It is not intended as a universal approach to a more complex contribution margin problem, but rather a suggested possible alternative to the conventional approach.

7.5 AN ABC APPROACH TO CONTRIBUTION MARGIN ANALYSIS

An ABC system identifies all the activities performed to produce and deliver a firm's output. The identification of activities, however, does not necessarily indicate their relevance in a decision model. Many firms incorporate a coding scheme to add qualitative features to the model (e.g. Turney 1993, Walker 1991, Cooper and Kaplan 1992a, Cokins et al. 1993). These schemes can vary from simple dichotomous ones, such as value-added or non-value-added or necessary/unnecessary, to complex schemes involving rankings using a point system. Other coding schemes include: reason codes, which provide insight into why activities are performed; purpose codes, which provide insight into whether the purpose of the activity is central or peripheral to the mission of the firm (Cooper and Kaplan 1992a); and control codes, which identify which activities are controllable in the short term and to what extent. Attribute coding is the vehicle by which qualitative information is incorporated into the contribution model. It permits management to enhance traditional cost information to allow for a more complex representation of economic reality.

It is suggested that through controllability coding and the differentiation of hierarchical margins a more useful decision model may be formulated in the application of the contribution margin approach.

7.5.1 Controllability levels. In the past, qualitative variables have been difficult to incorporate into a model that depends greatly on quantifiable variables. In order to fit such variables efficiently into a decision model, they must be assigned a manageable scope and identifiable unit of measurement. A manageable scope defines the range of control which management can exercise over costs and the unit of measurement is the establishment of incremental variables or cost drivers by which to measure complex cost behaviour patterns. The contribution margin approach depends on the establishment of quantifiable relationships to break down problems in a useful manner and aid in cost predictability. Understanding that complete accuracy should not be the motive, cost controllability variables may simply be defined in terms of high, medium and low. The scope of controllability can be measured by devising a satisfactory "rule of thumb" to aid in the hierarchy designation. For example, a high controllable cost may be assessed in terms of management's expectation of its ability to reasonably eliminate 90% of the cost within one year. A low controllable cost may be based on management's expectation that only 10% of the costs can reasonably be eliminated within one year.

Rather than forcing all variable costs into a single incremental section of the model, multiple sections can be added reflecting control layers. Those costs which are ranked as highly controllable can be more confidently expected to behave in an incremental pattern. Those costs ranked as low provide less confidence that these costs will be relevant in the short term.

7.5.2 Hierarchy of margin. The traditional contribution method forces costs into a single contribution margin figure by limiting cost variation to only the unit-based and ignoring all other costs. A multiple level approach to contribution margin analysis can be built by considering the variation bases employed by ABC (Kaplan 1990a). Rather than forcing all variable costs into a single margin, multiple margins can be calculated and presented together. This expanded approach is more likely to aid in the estimation of cost consequences in response to production volume changes since it represents a more realistic view of cost behaviour.

7.5.3 ABC contribution model. Continuing with the example from above, XYZ company's total cost can be expressed in terms of activities along with their associated costs, control code, variation base, and the occurrences of each variation using an ABC system. This is illustrated in figure 7.6 below:

ACTIVITIES OF XYZ COMPANY COSTS, CONTROL AND VARIATION BASES

activity	total cost	control	var-base	base-#
purchase order processing	£20,000	high	batch	300
setting up	5,000	high	batch	300
facility maintenance	10,000	low	facility	1
expediting	7,000	medium	batch	300
engineering changes	3,000	high	product	1
production testing	12,000	medium	unit	2000
inspecting	3,000	high	unit	2000
Direct costs:				
direct material cost	60,000	high	unit	2000
direct labour cost	90,000	low	unit	2000

Total costs	£210,000			
	========			

(figure 7.6)

To accommodate the new features, controllability and cost variation, the cost composition model must take on a two dimensional format. The horizontal axis represents cost variation bases and the vertical axis represents cost control aspects. A multi-level two-dimensional cost composition model can now be constructed. Continuing the example of XYZ Company and using the data from figure 7.6, a cost composition model is presented in figure 7.7 below:

ABC COST COMPOSITION MODEL:	unit	batch	product	facility
HIGH: controllable activity costs:				
direct materials	£30.0			
purchase order processing		£66.7		
setting up		16.7		
engineering changes			£3,000.0	
inspecting	1.5			
HIGH controllable costs total	31.5	83.4	3,000.0	£0.0
MED: controllable activity costs:				
expediting		23.3		
production testing	6.0			
MED controllable costs total	6.0	23.3	0.0	0.0
LOW: controllable activity costs:				
facility maintenance				10,000.0
direct labour	45.0			
LOW controllable costs total	45.0	0.0	0.0	10,000.0
TOTAL controllable costs	£82.5	£106.7	£3000.0	£10,000.0

(figure 7.7)

There are two important distinctions to make about the ABC cost composition model. First, activities rather than cost elements are used to represent cost. Second, there is no single cost calculated to determine which alternative to choose. All activities that conform to a unit-based cost variation are aligned in the unit column. All activities that conform to a batch-base variation are listed under that heading. At the same time the corresponding control level is designated. Those costs which appear closest to the top of the model are more likely to behave in the manner described by the variation base under which it is listed. Those costs near the bottom of the model are constrained in some manner and are less likely to behave neatly according to the hierarchical variation base. In other words, costs that are classified as highly controllable are more likely to behave as expected. A conservative approach to this analysis may be to limit predictions to the upper part of the model.

7.5.4 Analysis. To employ the new ABC contribution margin approach in the make-or-buy decision for XYZ Company, both the cost variation base and the controllability factor must be considered. First, the cost hierarchies are used to calculate a make-or-buy result and then control variables are introduced to assess confidence in the outcome.

Each cost hierarchy must be applied against its variation base to produce the cost effect from the decision. Unit-level costs must be multiplied by the number of expected units and batch-level costs must be multiplied by the number of expected batches and the same for product-level and facility-level costs. As with traditional contribution models, the concept of cost relevance plays a role. Those costs which are not expected to change as a result of the decision may be considered irrelevant. For XYZ Company, the facility is used for a number of products and can not be eliminated with the elimination of product-X. Therefore, all facility-level costs can be excluded from the decision. Figure 7.8 (below) shows the analysis for XYZ Company's make-or-buy decision for product-X using the new ABC model exclusive of the controllability factor:

XYZ COMPANY. ABC CONTRIBUTION MARGIN ANALYSIS	(total cost)
Cost to purchase 2000 units from supplier (£80 x 2000 units)	£ 160,000
Relevant costs to make:	
Unit-level costs: (82.5 x 2000 units)	165,000
Batch-level costs: (106.67 x 300 batches)	32,000
Product-level costs: (£3000 x 1 product)	3,000

Total relevant costs to make	200,000
Advantage to buy over make	(40,000)
	=======

(figure 7.8)

The analysis using the new contribution margin incorporating cost hierarchies indicates that it is more advantageous to buy product-X rather than making it, thereby saving £40,000 per year. In contrast to the traditional analysis, the ABC model performs the calculation in terms of total cost rather than unit costs. This is to accommodate the different cost variation bases. However, the analysis can not stop at this point. Control factors must be used to assess the confidence in the calculated result. Examining the ABC cost composition model back in figure 7.7 indicates that only £63,000 ((£31.5 x 2000 units) of the £165,000 unit-level cost are considered highly controllable. This is because labour and other costs are constrained in some way. As for batch-level costs, only £25,000 (£83.33 x 300 batches) of the £32,000 are considered highly controllable. If management wanted to analyze the make-or-buy decision based on highly probable outcomes in the short-term, the analysis could result in an entirely different outcome. Figure 7.9 below illustrates this:

XYZ COMPANY. ABC CONTRIBUTION MARGIN ANALYSIS	(total cost)
Cost to purchase 2000 units from supplier (£80 x 2000 units)	£ 160,000
Highly controllable relevant costs:	
Unit-level costs: (£31.5 x 2000 units)	63,000
Batch-level costs: (£83.33 x 300 batches)	25,000
Product-level costs: (£3000 x 1 product)	3,000

Total relevant costs to make	91,000
Advantage to make over buy	69,000
	=======

(figure 7.9)

When considering only highly controllable relevant costs in the model, the result is to make rather than buy product-X. This is because certain constraints for some of the relevant costs limit the extent to which unit-level or batch-level incrementation can be expected to occur. The make-or-buy decision, therefore, in part, depends on the control perspective management chooses to take.

Each margin can be used to determine that variation base's contribution to the profit equation. Instead of relying on a single distorted unit-based margin, ABC provides a more accurate way to apply the contribution margin approach and thus contributes to a more meaningful decision model for managerial decisions.

7.6 CONCLUSION

The contribution margin analysis is an important tool which can be applied to help managers organize, summarize, and simplify complex cost data. It is a systematic and efficient method of evaluating cost information and predicting outcomes in response to short-term production decisions. Over the years it has undergone little modification. With the introduction of ABC systems and computer technology, the contribution model has the opportunity of evolving into a more reliable and flexible tool for decision making. Qualitative factors, such as managerial control over costs can be incorporated into the model using coding schemes without sacrificing the efficiency and simplicity of the model. Multiple variation bases can be incorporated using activity cost, reflecting a more accurate prediction of cost behaviour.

The traditional contribution margin approach tends to overstate unit-level cost incrementation. This distortion may prompt management to error systematically in decision making, for example, as illustrated above, by endorsing a subcontracting policy when it may not be the optimal course of action. Care must be taken to construct short-term decision models which accurately reflect complex economic conditions without sacrificing efficiency and cost effectiveness. Management is continually challenged to adapt to new concepts of cost information, such as ABC. Traditional models need not necessarily be rendered obsolete, but may simply require adjustment to update and synergize old ideas with new ones.

SECTION TWO:

ACTIVITY MAPS AND THE THEORY OF CONSTRAINTS

7.7 INTRODUCTION

ABC and the Theory of Constraints (TOC) (referred to as Throughput Accounting (TA) for the remainder of this section) are both techniques which have developed in response to the need for better ways to examine resource consumption in a practical decision making context. ABC is generally seen as a technique which focuses primarily on analysing overhead. In contrast, TA focuses on the dynamics of the flow of production through the factory (Darlington et al. 1992). How can these two apparently diverse techniques ever be used in conjunction? This section explores the idea that some of the methodologies of ABC and TA are, in fact, complementary and can be used effectively as integrated elements of a single approach to cost management.

TA is concerned with balancing the flow of product with demand from the market place. This involves reducing or eliminating bottlenecks primarily caused by resource constraints. ABC, through activity mapping, can provide insight into the relationships among resources within the organization. This may help to establish where bottlenecks exist and guide management to their origins in a way which can provide some indication of how to alleviate or eliminate them. Goldratt and Fox (1986) describe the identification of the location of bottlenecks by walking through the factory floor and observing the work-in-process inventory backing up in front of various machines or processes. A much more constructive way to identify bottlenecks in the factory is by using activity maps.

Morrow and Hazell (1992) describe the use of activity mapping as an aid to business process improvement. Activity mapping is essentially a flow chart of activities that graphically displays the vertical interconnections of activities within a department as well as the horizontal connections between departments and cycle times necessary to perform each activity. Activity maps can provide decision makers with the tools necessary to identify and analyze bottlenecks and facilitate the application of TA. This section of Chapter 7 explores the combination of these two techniques and illustrates how they can be used together to improve throughput.

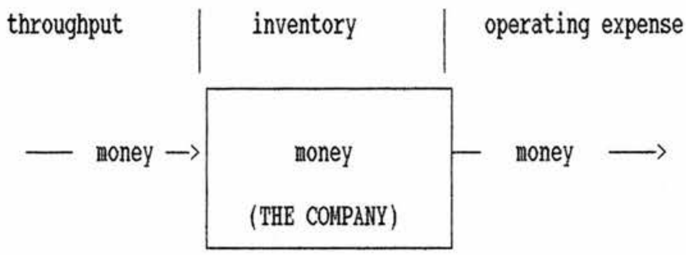
This section is organized by first introducing the basic aspects of TA, followed by ABC, and activity mapping. The use of activity maps to help find bottlenecks is then presented in a three step approach. The final part of this section is devoted to an illustrated example of how to use activity maps (consisting of Gantt charts and dependency grids) to help find bottlenecks.

7.8 THROUGHPUT ACCOUNTING

TA is primarily a manufacturing theory which attempts to focus management's attention on three basic objectives:

1. Increase throughput
2. Reduce inventory
3. Reduce operating expenses

Goldratt and Cox (1984) related these objectives to the basic theme of making money. They defined inventory broadly as "the money still in the system." This includes not only goods to be sold but everything purchased that could be sold like supplies, building, and equipment. Throughput is defined as "the money on its way in." This is the rate at which money is generated by transforming materials into sales revenue. Operating expense is defined as "The money on its way out." This is all the money spent to create throughput (Goldratt and Cox 1984).



The most important objective for TA is to reduce the level of inventory, because it has the largest impact on profitability. A manufacturing company is only profitable if the rate at which money is earned exceeds the rate at which money is spent (Waldron and Galloway 1988). Profitability is measured in terms of the rate at which the business contributes money relative to the rate at which money is consumed through expenses (Jones 1994). Since profitability depends on a time factor relating to inventory turnover, profitability is therefore inversely related to the level of inventory (Bromwich and Bhimani 1993). Waldron and Galloway (1988) have constructed various measures of throughput performance to ensure that every minute of operation is devoted to producing something that can be sold. The primary measure of profitability is therefore the ratio of sales margin (throughput) to total expenses.

$$\text{primary measure} = \frac{\text{throughput}}{\text{total factory cost}}$$

The numerator in the ratio shown above is calculated by deducting total material costs from total sales revenue. Total factory costs consists of all costs incurred other than direct materials costs (Waldron and Galloway 1989a). The pursuit of increasing the primary measure focuses management's attention on the basic objectives of increasing throughput, and reducing inventory and expenses.

All things held equal, increasing the rate at which a product travels from receiving to shipping would have the effect of reducing inventory and reducing money tied up in the system. Throughput is therefore increased by reducing the effects of bottlenecks or constraints in the chain of processes. A bottleneck is a resource that is pressed beyond its capacity. By continuing to push this resource, work-in-process inventory begins to build up from non-bottleneck resources that precede it.

Traditional cost management accounting leads to the build up of unreal inventory profits, the use of economic order quantities (EOQ) that are not economical, and the encouragement of local efficiency which is detrimental to global performance (Jayson 1987). This is because the traditional approach leads factory managers to focus their attention on the maximization of each and every resource independently. The underlying logic of this is that if all resources are utilized to their capacity then the entire system will yield maximum efficiency. Maximum efficiency translates into maximum profits. This sort of logic results in managers focusing on localized efficiency. Measurements like parts produced per hour per machine are used to measure plant operations. If a factory worker is left idle, this translates into a labour resource not being used efficiently, hence more work must to be found to bring the resource use up to capacity or consideration may be given to eliminating the resource altogether. The managerial objective therefore is to balance the capacity of localized factory resources with the demand on those resources (Goldratt and Fox 1986).

This sort of localized efficiency analysis has been supported for a long time by cost variance analysis and standard costing, a staple of cost accounting education and practice. Standard costs were developed to support the budgeting process and help control various aspects of the factory. Standards of capacity for each resource would be budgeted and all variances would be addressed. For example, a labour standard might be used to control the efficiency of a particular process. Management may conduct time studies to determine that an average worker in the drilling area should be able to drill 100 holes every hour. A standard is then set to evaluate this worker to make sure that 100 holes are in fact drilled each hour. If the worker only produces 75 holes, a negative labour efficiency variance results and management would attempt to bring the level of efficiency up to 100 holes. The aim is simply to support the idea that each resource has a predetermined capacity or standard that must be maximized in order to make more money for the company overall. Waldron and Galloway highlighted the motivational consequences for management, "When we measure standard hours produced, we create an environment in which we strive to keep people busy producing." (Waldron and Galloway 1989b). This is the idea that worker activation is the same as utilization. The result is a policy of trying to balance capacity with demand.

Indeed Waldron and Galloway suggest that balanced capacity is unattainable because organizations are constantly challenged by business fluctuations and disruptions (Galloway and Waldron 1988b). Even under the best of conditions, absenteeism and machine breakdowns will occur causing lack of work. As a result the 100% utilization is not ever a possibility (Coughlan and Darlington 1993). TA is based on the idea that one should not try to balance factory capacity, but rather the flow of production, with demand. There is a recognition that each factory resource has a different capacity level. That is, some employees work faster than others and some machines produce more parts per hour than others. Recognizing that each resource does not work independently, but rather is linked to others through the flow of production, is the central theme of TA. In other words, it's not important to maximize every independent resource, but rather to maximize the flow of product through the entire system. Thus from a TA perspective, the whole company is conceptualized as a large single resource for "making money".

To illustrate the idea, assume that process-A produces subassemblies for use in process-B. Also assume that process-A produces subassemblies twice as fast as process-B can use them. If these are the only two processes in the system, the system will only produce products as fast as process-B can produce them. Hence, the bottleneck governs the speed that a product flows through the system. Now assume that process-A is under utilized. That is, it sits idle for 50% of the time while process-B is pressed to capacity. Under a traditional localized approach to efficiency, process-A must be speeded up to improve its efficiency. On the other hand, process-B is of little concern since it is being utilized to its fullest. If management is successful in bringing process-A up to capacity of 100%, what would be the result? The company throughput would be unchanged since the system will still only be able to produce products as fast as process-B can produce them and therefore, from a TA perspective, no improvement would have taken place. This is because process-B can go no faster and it governs throughput. In fact, a negative result of increasing Work-in-Process inventory has occurred. There would just be a bigger pile of work-in-process inventory in front of process-B. The TA approach signals that it is better to leave a resource idle if this does not reduce the flow of product out of the door to the customer. Effort should therefore be placed on those resources that are near or over capacity. Since throughput is governed by the slowest process, it is the bottlenecks that deserve attention. This is the central issue on which ABC can contribute to the effectiveness of TA.

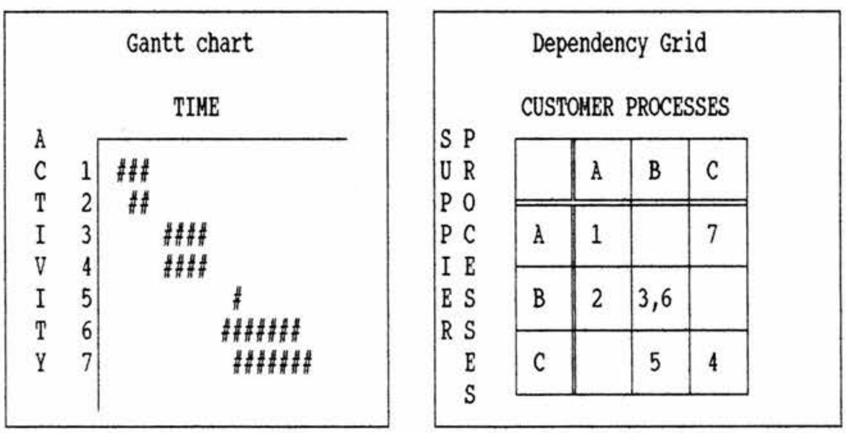
In summary, improving the flow of product through the factory increases throughput and causes inventory and operating expenses to go down. The more conventional idea that each resource needs to be pressed to capacity ignores the interrelationship of resources in the system, and results in an incorrect view of the organization. Traditional management accounting control techniques like standard costing have fostered this view. Standard costing treats the company like a collection of separate and independent investments, rather than a single organism designed for making money. The TA approach gives emphasis to finding bottlenecks and smoothing the flow of product through the system to increase throughput, reduce inventory, and increase profits. Reducing bottlenecks is therefore the path to balancing the flow of production with demand. Management needs a method of looking at the organization to help them determine where bottlenecks exist as well as how to reduce their effects on throughput. ABC has offered a new way to look at a company that allows managers to focus their attention on how work is performed in the context of activities.

7.9 ACTIVITY BASED COSTING

ABC was developed in response to the inadequacies of traditional costing methods. Conventional costing approaches created misinformation for managers because of their dependence on arbitrary allocation bases, such as direct labour hours, for assigning indirect costs to products. Over time, an increasing level of distortion and misinformation was created by the relative decrease in direct labour content and relative increase in overhead costs (Johnson and Kaplan 1987b).

ABC now extends beyond product costing and encompasses a range of cost management applications. These include the determination of customer profitability, and support for Total Quality Management (TQM) and Continuous Process Improvement programs. This evolution has resulted in a range of new terminology such as ABM, Activity Based Budgeting (ABB) and Working Activity Based Management (WABM) (Turney 1992).

The cost object, however, has remained primarily product, service, customer, projects, or functional area. Using activity mapping, the cost object definition can be expanded to include the business process itself. Business process can be broadly defined as a system for adding value. This includes all functions of the company which work together to add value to a product or service, and includes purchasing, accounting, marketing, and production. By defining the cost object as the business process, activities can be mapped to determine the flow of a product through the entire organization. The application of activity mapping contained in this chapter differs from Marrow and Hazell's (1992) maps in two ways. First, both production and non-production activities are incorporated into the map structure. Second, activities are mapped first by cycle time using a Gantt chart and are then placed inside a dependency grid to reveal activity interdependence. The basic structure of the maps are shown below. A Gantt chart is a two dimensional diagram relating time on the horizontal axis to activity on the vertical axis. A dependency grid is also a two dimensional diagram relating supplier-processes on the vertical axis to customer-processes on the horizontal axis. The Gantt chart directs management's attention to potential problem activities. Then the dependency grid is used to help managers determine the composition of the bottleneck. Gantt and dependency grids are shown below in figure 7.10:



(Figure 7.10)

Understanding the intricate web of activities within the production and related processes is the key to improving throughput and applying TA. This type of analysis facilitates just such an understanding.

7.10 HOW ABC ACTIVITY ANALYSIS CAN HELP FIND BOTTLENECKS

How would a factory manager begin to look for a bottleneck resource? One way would be the Goldratt and Cox suggestion of observing the factory floor for inventory backed up in front of a process. The problem with looking for bottlenecks by the observation or interview technique is that these techniques only work when the bottleneck is created sequentially. In practice, bottleneck creation (and therefore identification) can often be considerably more complex. This stems from the inadequacy of the definition of the term "bottleneck". The normal definition of a bottleneck resource is when a resource is being pressed beyond its capacity or when demand on a resource is greater than or equal to the capacity of that resource. It could be expressed as follows:

$$C(r) <= D(r)$$

Where, C(r) = (capacity of resource-R), D(r) = (demand placed on resource-R):

This definition follows the Goldratt & Cox explanation. They illustrated this linear definition of a bottleneck with the example of a group of boy scouts on a hike walking in single file. The bottleneck is discovered by identifying the slowest boy and locating the largest gap in the line. This simple sequential definition of bottleneck may lead management down the wrong path because bottlenecks may not be formed in this linear fashion.

To illustrate this point, suppose the factory manager, while looking for bottlenecks, discovers that the packaging process (a resource) is not keeping up with demand placed on it. He identifies this process as a bottleneck because he observes a very large pile of work-in-process inventory stacked up in front of the packaging machines. The manager then assembles his management team and goes to work on the packaging process with the aim of balancing the flow of production with demand. This results in an effort to either speed up the packaging process or to slow down the process that precedes it. The manager's efforts may be misdirected because the bottleneck may not be in the packaging process at all. The problem may be that the purchasing department orders the wrong size boxes or orders them at the wrong time so when the packaging machines begin to run, they have to wait for more boxes or adjust the machine to accommodate different size boxes. It may be the shipping department has not been able to prepare the skids on time for the packaged product to be delivered. The origins may be many and varied. The critical point is that a bottleneck may not necessarily reside in an individual resource or location, or even within the relationship of two sequential resources. A bottleneck is more likely to be composed of a complex web of interconnecting activities that cross functional areas of the company. The observance of a build up of work-in-process inventory clearly indicates a production flow problem exists. However,identification of a problem is not enough. Managers need to know how to define the problem, locate its source, and then address it effectively.

In a world where organizations perform activities (one after the other in a straight line) the problem of finding bottlenecks can become a matter of simply identifying where "the largest gap in the line of boy scouts" exists and then addressing the problem by reducing "the gap in the line" just before the resource. However, an organization operates in a non-linear world where processes or resources are dependent on myriad activities that in turn are dependent upon other processes. To define a bottleneck as existing inside a resource does not sufficiently address the complexity of the business process. To give visibility to this complexity, it is necessary to use activities to explain and understand the points between the gaps. This is a much more flexible and instructive approach and recognizes the nonlinear behaviour of the business organism. The bottleneck definition should be expressed as the condition where demand on a set of activities exceeds the capacity of a set of activities designed to support it. This definition recognizes that a process is made of activities and that throughput depends on the complex nonlinear coordination of activities within each process. A bottleneck can then be expressed as follows:

$$C\{a,a...\} <= D\{a,a...\}$$

Where, C{a,a...} = (capacity of a set of activities) and

D{a,a...} = (demand on the same set of activities)

Using this new definition of bottleneck, clarifies why activity mapping can facilitate the application of TA. The understanding of how activities interconnect is essential for bottleneck analysis. Activity mapping is an effective way for gaining insight into the complexities of activity interconnection that is necessary for increasing throughput.

Activity Maps are basically a graphic presentation of the existing and interconnecting activities of a set of business processes. Activity mapping for ABC applications has normally been applied to overhead activities such as quality control, set up, material handling, and purchasing. The mapping of these activities in addition to production activities can provide the three dimensional view of a company necessary to find bottlenecks because the flow of production in an organization is dependent upon coordination of both overhead and direct production activities. By gaining an appreciation of how direct production activities link to other areas of the organization, a more complete picture of the flow of production emerges.

Since a bottleneck has been redefined as a condition where demand on a set of activities exceeds the capacity of a set of activities, management needs a method of identifying those sets of activities where this condition exists. Activity mapping is designed to help highlight where gaps exist between activities and how these activities link to others. Once management knows the location of a bottleneck and has determined its cause, they can then focus their attention on correcting the capacity and coordination of activities that comprise the problem.

Activity maps can be constructed in various ways depending on the size and type of the organization, but to be applicable to TA, the maps must satisfy at least two requirements:

1. They must illustrate gaps between activities for both overhead and production areas of the company.
2. They must locate the set of activities that cause these gaps.

An effective way of activity mapping to achieve these aims is to employ a combination of Gantt charts and a dependency grids. Three necessary steps are involved in the analysis. For the purposes of this discussion, a process is defined as a series of activities that are linked together to perform a specific objective. For example, the purchasing process is a group of integrated activities that together compose the purchasing function of the organization. Activities are defined as a single unit of work performed within a process. Therefore activities are components of a process. Preparing a purchase order and then sending it through the proper channels are examples of activities in the purchasing process.

There are three basics steps to using activity maps to locate and reduce the effects of bottlenecks. These steps are as follows.

<u>1. The first step is to list all the activities in both the production and non-production processes in the organization.</u> Activities are usually determined and collected through a process of interviews. Group related activities by process and number them to make mapping easier. Normally ABC activities are expressed broadly where thirty activities might be considered too large and cost prohibitive. Activities for mapping purposes can be much

more detailed and even approach the task level, since not all of these activities need be used for costing purposes. In mapping it would not be uncommon nor cost prohibitive for activities to number in the hundreds. The activity list is presented in figure 7.11 below:

ACTIVITY LIST

PURCHASING:
1. examine MRP report
2. receive PO requisition form
3. file requisition by due date
4. call vendor for delivery info
5. update PO info record
6. print PO form
7. get authorization signature
8. send original PO to mail room
9. send PO copy to receiving

MATERIAL HANDLING:
10. receive PO copy
11. receive goods from vendors
12. prepare/update receiving record
13. inspect for damage & accuracy
14. tag each box as "received"
15. sort boxes by type
16. place boxes on target shelf
17. receive material requisition form from work stations
18. update material requisition record
19. deliver material to work station

FABRICATING:
20. receive workorder
21. prepare and send material requisition form
22. organize received materials
23. load materials into fabricating machines run it
24. send finished product to packaging process

PACKAGING:
25. receive finished product
26. prepare material requisition
27. sort product by type
28. check for bad product
29. set machine controls
30. load product into packaging machine and run it
31. monitor packaging machine for malfunction
32. deliver packaged product to shipping dept.
33. cleaned machine for next job

OTHER:
ACCOUNTING, CONSUMERS, VENDORS, ENGINEERING, ADMINISTRATION, ETC...

(Figure 7.11)

<u>2. The second step is to prepare a Gantt Chart with each activity listed along the vertical axis and cycle time across the horizontal axis.</u> Some activities can only be performed once a previous activity is completed, while others can be performed concurrently. Chart each activity across the time horizon depicting the average length of time required to complete it. Those activities that are dependent upon the completion of other activities should begin where the first activity finishes. For example, in the purchasing process, activity five can only begin once activity four is complete, while activity six can begin just before activity five

ends. Blank spaces should precede an activity if there is a wait or "do-nothing" period. This is evident between activity six and activity seven in figure 7.12 below:

ACTIVITY MAP GANTT CHART

```
                             CYCLE TIME IN MINUTES
           0   5   10  15  20  25  30  35  40  45  50  55  60  65  70
           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
PURCHASING:
       1.  ####################        |                           |
       2.  ###
       3.     ###                      |                           |
       4.        ##############
       5.                      ###### |                           |
       6.                          #####
       7.                                           #              |
       8.                              |            ##
       9.                                            ####
           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
MAT.HANDLG:
      10.  #                           |                           |
      11.  #
      12.  ##                          |                           |
      13.    ###########
      14.    ###########               |                           |
      15.              ############
      16.                          ############                    |
      17.  #                           |
      18.   #                                                      |
      19.           ###########################
           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
FABRICATNG:
      20.  #                           |                           |
      21.   ########
      22.                    ######## |                           |
      23.                         ##############
      24.                                       ##
           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
PACKAGING:
      25.  #####                       |                           |
      26.       ##
      27.                          ##################              |
      28.                          ##################
      29.            ##                |                           |
      30.                                            ###########
      31.                              |              ###########  |
      32.                                                       #
      33.                                                       ####
           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
```

(Figure 7.12)

<u>3. The third step is to prepare a Dependency Grid where different aspects of each process are represented both on the vertical and horizontal axis.</u> The horizontal axis represents the processes that are recipients or customers of other processes. These processes listed on the horizontal axis are dependent on activities from processes listed on the vertical axis. The vertical axis represents those processes which provide support to processes on the horizontal axis. Consider each activity separately and ask the following question. "What process does this activity directly support and/or what process does this activity directly depend upon?" The activity number is then placed inside the dependency grid in the box or boxes that best characterize its position in relation to the others. Activity numbers six and eight are performed within the purchasing process as a supplier to the fabricating process. Also notice that activity eight supplies the packaging process as well. The activity may support a number of other processes or even be an activity that both supports and is dependent upon its own process. Purchasing activities three and five support and are dependent upon the purchasing process because both of these activities are performed to maintain and facilitate the other activities performed within the purchasing process. The intersection points of this grid indicate which sets of activities depend upon and/or support which processes. The dependency grid is shown below in figure 7.13:

ACTIVITY DEPENDENCY GRID

CUSTOMER PROCESSES

SUPPLIER PROCESSES	PURCHASNG	MAT.HADLNG	FABRICATNG	PACKAGNG	OTHER
PURCHASING	3 5	9 10	6 8	8	5 6 7
MAT.HANDLG	12 18	14 15 16	13 21 17 19	17 19 26	11 12 18
FABRICATNG			22 23	24 25	20
PACKAGING		27 32		30 31 33	28
OTHER	1 2 4				

(Figure 7.13)

The map of activities through use of the Gantt chart provides a basis for locating the gaps between activities, and the Dependency Grid provides a means of identifying which set of activities are involved in the bottleneck. Both of these help to complete the bottleneck equation C{a,a...} < = D{a,a...}. An example is provided as a practical illustration of these ideas in the following section.

7.11 HOW TO USE ACTIVITY MAPS: AN ILLUSTRATION

An example of how the inter-relationships in the processes of purchasing, material handling, et al., can be implicated in the creation of bottlenecks is used to illustrate how activity mapping can be utilized in practice to identify and guide their coordination and rectification.

The sequence for analysis is as follows:

1. Examine the activity map Gantt chart and look for the longest graphed horizontal lines. In the purchasing department, activity one (examine MRP report) and activity four (call vendor for delivery information) consume the largest amount of time. In the packaging process, activity twenty seven and twenty eight (sorting product by type and checking for bad product) have the longest cycle times.

2. Using the activity map again, examine the process and look for the largest blank spaces between activities. In the packaging process a large space exists between activity twenty six and twenty seven. This represents a wait between preparing a material requisition form and sorting product by type. Management will want to inquire why there is a long period of time between these activities and to investigate how this gap can be shortened. Throughput will be most affected by the activities with the longer cycle time and the longest blank space adjacent to it. This is the situation in the packaging process where a long gap exists between activity twenty six and activity twenty seven, while activity twenty seven has a long cycle time. At this point the manager knows there is a problem in the packaging process getting the material requested (activity 26) in time for sorting activity 27. The question then becomes which set of activities creates this problem?

3. To find the set of activities that comprise the bottleneck, it is necessary to examine the Dependency Grid and look for the relevant activity numbers. It is evident by examining the dependency grid that packaging process activity twenty six is dependent upon the material handling process activities seventeen and nineteen. In other words, for the packaging process to receive its materials on time depends upon the material handling process completing material requisitions forms (activity 17) and delivering those materials to the requesting work stations (activity 19). In this case, the bottleneck equation could therefore be written as follows:

$$C\{17,19,26\} <= D(17,19,26\}$$

Where C{17,19,26} is the capacity of activities 17,19,26) and D{17,19,26} is the demand placed on activities 17,19,26.

4. Turning back to the Gantt Chart in figure 7.11, two other factors are noticeable. First, there is a long wait between updating records (activity 18) and delivering the material (activity 19). Second, the activity of delivering the materials has a very large cycle time. An investigation may show that workers responsible for receiving the material requisition forms are not forwarding these requests to the warehouse in a timely manner, or perhaps it may be that a disorganized warehouse results in a long search for the requested materials. There may be a long trail consisting of many processes and activities that comprise the bottleneck.

5. The final stage is for management to consider new options, and alternative ways to redesign the process. The above analysis permits this to be done from an informed position. The manager, recognizing that the linkages between activities comprise bottlenecks, thus becomes much more able to focus attention on controlling the flow of production through the system.

7.12 CONCLUSION

TA has brought a new dimension to production philosophy and has posed an interesting challenge to the traditional ways of looking at company profitability. It recognizes that a company is not a collection of separate investments which can be managed independently, but rather a complex interrelated system of resources which require integrated coordination. TA achieves this by focusing on the flow of production through the system in order to increase throughput by eliminating the effects of bottlenecks and reducing inventory and operating expenses. All of these factors contribute to the single aim of making money.

ABC can complement these benefits. It has brought new insight into how organizations consume resources. It has made the "activity" the primary controlling mechanism for process redesign. Increase in throughput can be achieved more efficiently through focusing on the coordination of activities, rather than physical resources, to improve production flow. Bottlenecks can be more usefully defined as the situation where the demand on a set of activities is greater than or equal to the constraints of the same set of activities designed to support it. The linking of production and non-production activities through activity mapping can contribute to finding bottlenecks and isolating their causes. The result is not only an increase in throughput but the forming of a more complete understanding of the business organization.

TA and ABC are not mutually exclusive. They are both valuable techniques in their own right. Together, however, they offer significant synergistic benefits which cannot be obtained from their individual applications.

In addition to the technical constructions associated with the implementation of ABC, organizational issues are of equal importance. In the following chapter the organizational and operational effects of implementing ABC are discussed.

CHAPTER EIGHT

ORGANIZATIONAL STRUCTURE & OPERATION

8.1 INTRODUCTION

There has been a significant amount of research into the operational and methodological issues surrounding ABC (Johnson 1987, Cooper 1988b, Cooper and Kaplan 1991b, Brimson 1991). However, little is known about the intended and unintended organizational consequences and changes which accompany the introduction of a new costing system. There has been a growing need for management not only to understand the technical nature of the accounting discipline but also to understand the wider impact of accounting upon the organization. Examples of accounting changes impacting on the organization include the changing role of accounting personnel and the changes in power and influence among organizational members. Consequently, there have been calls by case study researchers in management accounting to explore the process of change and to understand more fully the different organizational implications of new costing systems (Hopwood 1987, Johnson and Kaplan 1987a, Innes and Mitchell 1990c, Bruns and Kaplan 1991, Scapens and Theobald 1992).

Although accounting techniques are often presented as a means to reach specific intended goals, they often produce a variety of unforeseen side-effects within the organization.

Bhimani and Pigott (1992a) suggest that ABC's technical impacts give rise to a wider level of organizational repercussions, which may not necessarily be predictable. Although organizational effects produced from technical accounting changes are difficult to determine, they are part of the common goal of a cost system. Indeed, the extent to which a cost system is successful is inherently linked to organizational and behavioural implications (Shields and Young 1989). For instance, Covaleski and Dirsmith (1986) suggest a relationship between budgetary control systems and political organizational power. Bariff and Galbraith (1978) also identify a link between control over methods of allocation and negotiating power. In addition, Foster and Gupta (1990) suggest that successful cost system changes are dependent upon the educational evolution of the organization and the nomenclature used to define the system. A contingency theory framework can be used to join the accounting technical changes to the effects of organizational and operational changes.

It is widely accepted that social and behavioural factors are implicated in changing cost systems (Cooper and Kaplan 1991b). Indeed, the main purpose of a costing system, and the basis by which it should be judged, should be the extent to which it advances desired organizational behaviour (Kaplan and Norton 1992, Lewis 1993).

This chapter is divided into two parts. The first part is devoted to a discussion of the relevant issues surrounding the organizational structure changes associated with altering cost systems and implementing ABC. The second is an outline of some of the operational consequences of using activity data and employing ABC management techniques.

8.2 ORGANIZATIONAL ADJUSTMENT

Organizational changes occur indirectly through the actual data which is produced from the new cost management system. These changes do not necessarily occur as a result of specific decisions, or from analysing accounting information. Rather, they occur indirectly as the organization and its members adjust to new ways of communicating and perceiving the company and to the fitting of a new cost system into the existing domain. Contingency theory could help to explain the way organizations adapt to and change with new systems. As technical ABC changes are introduced, organizational forces react to and adjust to the new changes. In turn, organizational responses influence the technical nature of the changes. The appropriate ABC system is dependent upon contingent internal organizational and external environmental variables. For example, a company which possesses a high level of product complexity may design an extensive ABC system to accurately determine costs. In contrast, a company with a simple product structure may only require a limited, less sophisticated cost system. The contingent variables in the processes of accounting change are thus important to the understanding of how the implementation of an ABC system affects organizational structure.

Research has highlighted the pervasive extent to which ABC principles are used throughout many areas of management accounting (Mitchell 1994a). In addition to product costing, they have been used in budgetary control, decision analysis, performance evaluation, and inventory evaluation.

For an ABC system to "fit" into an organization, adjustments to both the cost system and the organization are required. Certain changes have been identified and associated with the implementation of ABC systems, either as intentional organizational strategy or as unintended consequences. Some of these adjustments include the changing roles and perceptions of accountants, the shifts in power of organizational members, and the evolution of accounting language. The necessary organizational changes required to facilitate the successful implementation of ABC can be resisted by the status quo of the existing organizational structure, and because of fear of change from its members.

8.3 ACCOUNTING INFORMATION AND ORGANIZATIONS

As Emmanuel et al. (1990) point out, organizations are complex and dynamic worlds consisting of people and technology working together. This complexity is evidenced by the wide array of activities and functions performed and coordinated to produce a product or provide a service. For example, in manufacturing industries, raw materials are bought, sold, processed, and transported. In addition, external enterprises and their activities also work together with the organization to access the market place. Products must be contracted, processed, advertised, distributed, and sold. This transformation process requires a coordinated effort of people, technology, policy, strategy, culture, and a system of accounting for costs (Emmanuel et al. 1990).

Accounting systems help to define and change an organization. Accounting is a common language by which management can cope with the complexity of the enterprise. The accepted rules and standards of accounting, developed over many years, provide the framework by which organizational members communicate and organize the business environment.

Organizations and accounting techniques work together, shaping and influencing each other. Cost systems help management collect and analyze important information to help them set prices, reduce costs, and motivate desired behaviour. Accounting systems serve to direct the company according to management's desired objectives. At the same time, organizations influence the character of the cost system itself by changing the way data is collected and organized. For example, a service company is unlikely to possess elaborate inventory cost tracking systems and complex product costing models. There is a reciprocal relationship between costing management systems and the organization. Each influences the other, defining their own constitution. The correct match of business environment and cost system design is unique to each organization. No one solution could take into account all the complex array of variables. Contingency theories help to explain this phenomenon.

8.4 CONTINGENCY THEORY

Contingency theory could be a means of explaining the organizational changes which occur through introducing new cost information (Innes and Mitchell 1990a). The contingency theory is based on the premise that there is no universally correct course of action appropriate for all organizations (Bryman 1988). Accordingly, no cost system is correct for every organizational context. Contingency theory attempts to match specific systems techniques with specific characteristics of organizations. In other words, certain organizations require one system, while other systems are appropriate for another. A certain set of contingent features within the organizational context determines the appropriate cost system. The three main contingent variables are environment, technology and organizational structure (Emmanuel et al. 1990).

8.4.1 Environment. One of the roles of a cost system is not only to manage and control the organizational internal structure, but to adapt to the external environment which surrounds the organization. Environmental factors include governmental regulations, the economy, the competitive climate, and market characteristics. These environmental factors influence the design and shape of cost information systems. Johnson and Kaplan (1987a) concluded that activity accounting had resurfaced because of new competitive pressure and lack of relevance of traditional methods to modern businesses. Indeed, Khandwalla (1972) suggests that different types of competition such as pricing, marketing, and product mix, have very different impacts upon the design, use, and structure of cost systems. Bruns and Kaplan (1991), in their study of Baker Corporation, identify competition as the most important external factor for stimulating managers to begin to work on a new cost system. Even the use of costing information by managers could be influenced by external economic conditions. Otley and Wilkinson (1978) describe the use of budgetary information by managers to be, in part, dependent upon the severity of economic conditions. There are a number of other researchers who support the idea that environment influences the design and content of cost systems. For example, Amigioni (1978) suggests that the degree of environmental complexity influences the use of "control tools". Gordon and Narayanan (1984) concluded that there was a high correlation between uncertainty and the extent of control information. The impact of external environmental variables upon the nature of cost systems is far from complete. However, research suggests that these factors ought to be considered when designing cost management systems (Hopper and Berry 1983, Gordon and Narayanan 1984, Otley and Wilkinson 1988).

8.4.2 Technology. Technology is another contingent variable which impacts upon cost system design. Technology influences cost system design directly by enhancing the system's capabilities, and indirectly by changing the production process. Indeed, emergence of ABC could not have come into practical use without the existence of efficient and affordable personal computers. The use of activities for allocating joint cost to products was conceived long ago by Staubus (1971). However, the limited technology of the time could not accommodate this new cost design. The level of technology thus plays an important role in determining the nature, character, and influence of cost system design. The level of accuracy is also confined within technology constraints (Emmanuel et al. 1990).

Information processing technology has an impact on the type of information which is provided. For example, budgetary information may contain elaborate and complex allocations of joint costs, or be restrained to a single denominator allocation base, depending upon the sophistication of data collection and reporting systems. The advancement of processing machines has changed the way cost systems address allocation of joint costs. With the increased use of machines and the relative decline in direct labour, traditional allocation methods have become less relevant. Johnson and Kaplan (1987a) suggest this as one of the main reasons for the adoption of activity-based systems. Other researchers suggest that the change in production technology influences the design of cost systems. Piper (1978) found that the degree of task complexity impacted upon financial control variables in the reporting structure. Merchant (1985) has found some evidence which suggests that the propensity of managers to create budgetary slack is inversely related to the extent of automation in the firm.

8.4.3 Organizational structure. The organizational structure of the firm also influences the nature of the cost system. For example, the size of the organization may affect the level of control arrangement. A company will initially organize on a functional basis, using budgetary control systems based on profit centres. As the firm grows, getting exposed to more complex products and organizational hierarchies, the focus of control systems moves toward a more autonomous system (Williamson 1970). Merchant (1985) suggests that contingency relationships exist between the size of the organization and the type of costing system used. For example, larger organizations rely more heavily on the accuracy and control mechanism of the costing system than smaller organizations. Larger organizations exhibit an increased propensity for budgetary participation among organizational members. Smaller organizations rely more on personal relationships and direct communication (Merchant 1985).

The extent to which contingency theory is helpful in addressing the organizational issues raised by implementing an ABC cost system is questionable. The relative importance of contingent variables, described above, to organizational change and cost system design remains unclear. In particular, the impact of a combination of controls used in conjunction has yet to be fully researched (Emmanuel et al. 1990). In addition, there is no universal agreement on which sets of variables are important to consider, nor are the definitions of these variables commonly conceived. Also, contingency theories do not adequately consider, the dynamic nature of the organization. This is because contingency theory is normally based on a cross sectional analysis at a specific point in time (Innes and Mitchell 1990a). However, the contingency theory framework does provide valuable insight into understanding and conceptualizing new costing system design implications against the process of organizational change. This is because one would expect the contingency variables to be implicated in the changes process, given their supposed influence on practice.

8.5 THE PROCESS OF ACCOUNTING CHANGE WITHIN ORGANIZATIONS

Contingency theories can also be used to help understand the process of accounting change within the organization. Innes and Mitchell (1990a) draw on some contingency theory concepts to identify the underlying forces which have an impact on the way accounting evolves within an organization. The key contingent variables of technology, organizational environment, and structure are used to explain why management accounting systems differ from firm to firm.

Organizations change their management accounting systems for a number of reasons. For example, a competitive market place may force a firm to look more deeply into costs and efficiency measures. Indeed, Johnson and Kaplan (1987a) suggest that the increasingly competitive environment of the last decade has led to a growing dissatisfaction with current management accounting information. This dissatisfaction has helped to bring new accounting techniques, such as ABC, into the forefront of professional and academic debate. Production technology, organizational and product structure, management influence, and economic hardship are all factors which can provide the impetus for a firm to change the way it constructs and utilizes accounting information (Innes and Mitchell 1990a).

Changing the cost management system can influence both the operational complexion of the organization as well as the role of the accounting function. Operational changes relate to work practices and include new performance indicators, different approaches to product costs, and new methods of allocating responsibility for overhead. With ABC systems, management accountants become more a part of the management team. This direct involvement with other departmental managers leads to the development of more relevant accounting information, and a new appreciation by other organizational members of the contributions made by accountants (Innes and Mitchell 1990a, Friedman and Lyne 1995).

8.6 THE ROLE OF THE ACCOUNTANT

Implementing ABC systems not only changes the character of cost system design, it changes the way the accounting function operates and integrates into the wider organization. The implementation of ABC systems tends to change the role of the accountant in three ways. First, technical tasks are changed due to the application of new costing procedures. Second, cultural adjustments are made because of new information requirements. Finally, the perception of accountants by other members of the organization changes as new relationships are forged from the way in which cost data is used to describe economic reality.

8.6.1 Technical changes. ABC requires the accountants to report on a wider range of factors within the organization than those encompassed by conventional costing systems. Traditional techniques, such as standard cost and variance analysis, needed only to be computed "behind closed doors" within the accounting department. Little interaction was required to gather and report this sort of information. In contrast, activity-based information requires accountants to use more creative means of collecting and reporting relevant cost information (Johnson and Kaplan 1987a, Cooper and Kaplan 1992a, Innes and Mitchell 1995). The accountant needs to set up new data retrieval systems to collect financial, as an increase in cooperation with various functional managers, and the development of an understanding of how the rest of the company operates. In an ABC environment, accountants, therefore, tend to spend more time talking to other managers attempting to identify new cost drivers and performance measures. Rather than spending the majority of their time producing traditional cost variance analysis and budget reports, accountants begin to engage in work process analysis, strategic system design analysis, and feedback analysis. More time is spent making presentations, talking with functional managers, and participating in management meetings. Indeed, the extent to which the implementation of ABC is successful depends upon the changing role of accountants. Friedman and Lyne (1995) studied eleven cases in which this phenomenon occurs. Only in the cases of implementation failure did the traditional roles of accountants continue without modification. The changing role of the accountant may be a consequence of the cultural changes when implementing ABC, but more likely it is a necessary evolution in its success.

8.6.2 Cultural changes. Shields and Young (1989) describe culture as one of the behavioural factors which should be considered in the successful implementation of a new costing system. Focusing on culture when implementing new cost management systems is important for two reasons. First, research shows that the firm's culture is closely linked with its systems (Deal and Kennedy 1982, Davis 1984). Second, cultural evolution accelerates the rate of continuous improvement and acceptance of system changes (Peters and Waterman 1982). There is a wide range of beliefs about what constitutes culture. For example, culture could be defined as:

> "The patterns of shared beliefs and values that give the members of an institution meaning and provides them with the rules of behaviour in their organization."
> (Davis 1984)

> "The way we do things around here."
> (Deal and Kennedy 1982)

"The way we do things around here."

(Deal and Kennedy 1982)

Bhimani and Pigott (1992a) used case study research in a British pharmaceutical company to suggest that, after implementing ABC, accounting roles change as a result of cultural power shifts in the entire organization. The success of the new costing system relied extensively on the accountants gaining an understanding of the manufacturing process, operational issues, and production activities.

8.6.3 Perception of accountants. In order to implement an ABC system successfully, extensive inter-organizational coordination is required. Accountants could no longer perform their functional role by performing abstract computations inside an office separate from the rest of the company. The changes in technical procedures and cultural evolution necessary for a successful ABC system help to create a new relationship between accountants and members from other departments. In the eleven cases studied by Friedman and Lyne (1995) and in eight cases researched by Cooper and Kaplan (1992a) the recurring theme, prior to the implementation of ABC, was that accountants were characterized as "bean counters" performing tasks in their "ivory tower", creating endless amounts of irrelevant information. The absence of interaction between accountants and other members of the company resulted in mistrust and fear. Many functional heads of departments did not want accounting managers to know too much about their operation. Key performance measures, produced internally by the department, were kept from the accounting department because of fear and resentment (Cooper and Kaplan 1992b).

With the implementation of ABC, the actual location in which accountants worked changed. This change occurred in two ways. First, accountants devoted more time talking with other departments, visiting the factory floor , discussing performance measures, cost drivers, and activity information. Second, as with some of the cases studied by Cooper and Kaplan

(1992a), the physical location of the accounting office had been moved closer to the operational location of the company. This physical connection between the location of the accounting office and the rest of the organization underscores the relevance that accounting information has with the operational aspects of the company (Foster and Gupta 1990).

The coordinated efforts of accounting and the other functional areas of the company changed the way accountants were perceived by others as well as in the way in which accounting personnel saw themselves. No longer were accountants performing arbitrary allocations of overhead costs based on direct labour hours and justifying that as a generally accepted method of cost allocation. Accountants perceived themselves as playing a more legitimate role because their work was now based on knowledge gained from understanding the company in broad terms, having linked all the functional areas together to form a more meaningful interpretation of performance measurement (Bhimani and Pigott 1992b). Accountants had more of an understanding of the language used in operational processes and used this information to help represent the organization in more relevant terms. The accountant's domain of action was now perceived as less to do with accounting and more to do with the rest of the organization (Turney 1992).

8.7 SHIFTS OF POWER

As mentioned in the previous section, ABC is often associated with changing the way managers develop and use accounting information. Shifts in power among the organizational members may occur as a result of implementing an ABC system. Power balances can be disrupted by the changes in performance measures and reward systems, as well as in how information is collected and distributed throughout the organization.

8.7.1 Performance measures. Traditional performance measures are highly financial in nature and are determined by comparison to some standard cost or budget figure. The deviation of the actual cost from the standard represents the main form of performance evaluation in traditional systems. For example, departmental evaluations in terms of cost control is based upon how far the department generated overhead costs beyond predetermined budget levels. ABC systems create new forms of performance measurement which include non-financial as well as financial indicators.

Using cost drivers to measure the level of resource consumption provides an opportunity to evaluate performance in operational terms. For example, distribution performance could be evaluated by the number of missed delivery dates, and the engineering department could be evaluated in terms of the number of parts designed for the product. The cost driver thus serves as a versatile measuring tool for assessing the performance of a variety of different operations and processes.

Shifts in authority and power can occur in an organization through the availability and universal acceptance of cost driver measurements. Changes to processes and methods would be justified on the basis of their effect on cost driver transactions. No longer would the production manager necessarily be restricted to a financial interpretation of proposed courses of action. For example, Bhimani and Pigott (1992a) studied a pharmaceutical firm in which factory managers exhibited increased power, and flexibility, in their ability to make changes in the production process. The factory managers used ABC logic to legitimatize and justify their actions. Bhimani and Pigott noted that arguments were increasingly represented in ABC terms as a tactic to gain acceptance, and influence the organizational and operational environment.

8.7.2 Reward systems. Most sales departments are evaluated on sales and gross profit levels relative to budget figures. Bonus and commission plans to determine the appropriate reward distribution are based upon this information. ABC systems disrupt the established measures of product profitability and thus redefine the reward output. ABC research suggests that high volume low complexity products tend to be over-costed in traditional systems, while low volume highly complex products are under costed (Cokins et al. 1992). Incorporating new ABC information into the commission plan could severely penalize sales department rewards. For example, under the traditional costing system, if it was believed that a low volume highly complex product yielded a good gross profit, sales plans and marketing strategy may have been designed to focus on this product to capture more of the market share. Applying ABC information would likely lower the profit on this product, reducing total earnings and consequently the assignable rewards. In contrast, other products may become more profitable, increasing the reward for simpler type products. It may take some time to convert a product strategy from one emphasis to another and to adapt product complexity as a component of the reward equation.

In this context, the ABC system shifts power away from the sales department, limiting its ability to determine its own rewards. This is because profitability is no longer measured in simple traditional gross profit terms. Other factors, such as the complexity of the production process and the number of parts, influence a product's profitability. For example, engineering for product design will affect product complexity and thus have an impact on gross profits. Sales and marketing rewards become linked to performance with in other areas of the company. However, because rewards are more dependent upon inter-company cooperation, there is a greater possibility for conflict among organizational members. For example, the sales manager may feel penalized for the production department's inefficiency.

8.7.3 Data collection and distribution. Financial information tends to be a highly guarded commodity in a traditionally run organization. Information is distributed on a "need to know" basis. Often crucial data is withheld on the grounds of organizational security. The very structure and complex language of accounting information limits access to many organizational members. The process of building and using an ABC system requires the distribution of previously restricted information to many areas of the company. This distribution of information is necessary in order to construct a fully integrated cost management system. Divisional managers are often given information about other areas of the company to which they would not ordinarily have access. For example, sales management is given production process information to assess product profitability. Indeed, many ABC systems are actually built by a multi-functional team sharing cost information among them. Access to a wider range of cost and performance measures about the organization permits a more holistic view of the company. To some extent information is power. Increased access also allows for a wider sharing of power.

8.8 THE EVOLUTION OF LANGUAGE

How an organization is structured, defined, and changed is partly dependent upon the language of its members (Morgan 1986). The language of ABC provides new paths of understanding to the meaning of "cost" and how to manage it (Galloway and Waldron 1988). In order for the concepts of activity accounting to be applied in the organization, a new language must be learned (Cooper 1983).

ABC, like other new management accounting techniques of the 1980's, came with a set of new words and concepts. Acronyms such as TQM, JIT and ABC became the "buzz words" of academic and professional groups. Some of the common terms used in ABC, such as "cost driver", "activities", "cost hierarchies", "value added", and "cost pools" have begun to appear in text books and company strategic plans (Burch 1994). The new ABC vocabulary is, in a sense, a way of explaining what has been too difficult to explain in the past. Notions about how costs are consumed, and how resources are deployed, in a complex production environment were often reduced to "hunches" and "gut feelings". For example:

> "It has added to the vocabulary you know, little bits at a time. ... but I think it (ABC) has simply encompassed a lot of things that we had been trying to do, but hadn't been able to put a shape or feel on." (Interview with a manager from Brent Company)
>
> (Friedman and Lyne 1995)

A cost vocabulary which is commonly understood encourages common approaches to cost management. Thus, a universally understood way of talking about costs increases the effective and efficient communication of ideas, and encourages cooperation (Scapens and Roberts 1993). Functional borders become less restrictive. Intercompany processes and procedures become transparent to organizational responsibility borders (Bhimani and Pigott 1992). For example, in Cooper and Kaplan's (1992a) case study of Kraft foods, the food processing factories were operating under outdated guidelines which the quality control department had superseded by new standards. It was not until managers from these two functional areas began to discuss activities and processes which linked the two departments, that they discovered this error. At John Deere, MacArthur (1992) identified the interlinking of accounting, manufacturing, engineering, and the computer systems department as the primary interdisciplinary group critical to the implementation of ABC. The involvement of key functional departments in ABC projects leads to the development of a cost system which is broadly based and satisfies the interest of every department. ABC language provides a common ground for dialogue between managers from diverse areas of interest.

8.9 RESISTANCE TO CHANGE

Significant delays in the implementation of ABC can occur because of organizational resistance to change (Argyris and Kaplan 1994). By dealing openly and directly with this resistance, organizational barriers can be minimized. Cooper and Kaplan (1992a) identify two factors which prevent the implementation of ABC systems' progression from analysis to action. The first is the lack of understanding of the complex technical aspects of ABC. The second is the defensive behaviour induced by embarrassment or threat of having to act in an unfamiliar manner with new information.

To overcome these factors, education and training must target these potential problems. The education strategy to overcome the technical understanding of ABC is very different from the training necessary for dealing with defensive behaviour towards organizational change.

8.9.1 Technical barriers. Understanding the technical concepts of ABC requires organizational members to think differently about costs and their connection to the organization. Traditionally accepted notions of cost concepts such as "fixed" and "variable" need to be redefined. For example, the traditional meaning of "variable cost" is any cost which does not change proportionately with production volume. The ABC notion of variable cost is very different. Variable cost, in an ABC system, is any cost which could change in relation to some cost driver based on a specific time horizon. In other words, all costs are potentially variable. This complex, and often confusing, definition of variability causes operational managers to reject the validity of such a concept. In addition, some managers are reliant upon a fully absorbed unit cost and are uncomfortable using information they do not understand in a decision making context.

Managers must relearn what "unit cost" means in an ABC environment. Activity-based systems rely less on arbitrary allocation methods. Rather, cost drivers are used to approximate cause-and-effect relationships between activities, resources, and cost objects. Consequently, the distinction between "variable cost" and "fixed cost" becomes less meaningful. On the other hand, some finance and operating managers have understood the arbitrariness of a fully absorbed unit cost and have opted to use it for both short-term and long-term decision making, while accepting its limitations. Traditional notions of cost variation make it very convenient to use techniques such as cost-volume profit analysis and contribution analysis. Managers assume that any cost which does not increment with production volume will be fixed and thus unaffected by short-term decisions. With ABC, these managers must be educated to understand that short-term decisions eventually accumulate into significant fluctuations in the level of resources supplied and demanded in the organization in the long run (Bhimani and Pigott 1992a). Thinking must be redirected from short-term spending decisions to long-term aggregate changes in resource supply. If thinking about costs in terms of these technical changes does not occur, management acceptance and endorsement of the ABC project will be limited.

8.9.2 Organizational barriers. In addition to the technical changes which occur and must be absorbed by managers, organizational adjustments must also be endured and managed. Most organizational change is accompanied by fear of change. This is because organizational change disrupts positions of power, calls into question the established and accepted roles of its members, and changes the rules of engagement (Emmanuel et al. 1990). If managers do not truly understand the process and purpose of ABC, they are unlikely to endorse it. Even if the concepts are understood, old methods of performing work are difficult to give up for new, untried, and unfamiliar methods. Contained in the eight case studies conducted by Cooper and Kaplan (1992a) are typical responses reflecting the resistance to organizational change. These are given below:

1. "We've never made decisions on this basis."
2. "I would rather fail using cost information I am familiar with than fail based on this ABC information."
3. "I'm too old to learn a new approach."
4. "Things are not bad around here; if it's not broke, why fix it?"

The organizational resistance is aggravated by ABC implementation plans which fail to address the human element sufficiently in changing a costing management system, and the organizational process of change (Scapens and Roberts 1993). Pettigrew (1983) argues that organizational change usually suffers from a lack of focus on the context in which the change is to take place.

8.10 OPERATIONAL CHANGES

Operational changes are modifications and adjustments made to the organization which are due to intentional decisions based on activity accounting analysis. Analysis includes, among others, business process analysis, value analysis, hierarchy analysis, and cost driver analysis.

8.10.1 Change through Business process analysis. Business process analysis identifies and measures the cost of major processes along a company's value chain. A process is a series of activities that are linked to perform a specific objective (CAM-I Draft Document 1990). For example, the process of assembling engines for a car manufacturer requires a number of linked activities, which may include processing purchase orders, receiving, storing engine parts, and delivering engines to the manufacturer. The value chain is a set of activities within a process which adds value to the product from the perspective of the customer.

Business process analysis allows management to view the organization across functional lines, because the set of activities contained in a process typically comes from many different areas of the company. For example, the procurement business process at Farrall Inc (Cooper and Kaplan 1992a) encompassed the costs of the activities performed to source, order, and receive raw materials. These activities were performed in a number of different departments. For instance, the sourcing of vendors for materials was performed by the Purchasing Department, and the processing and payment of vendor invoices was performed by the Accounts Payable Department. Operational changes were made addressing how these departments related to each other. The connections between activities thus becomes a new dimension for management focus. Morrow and Hazell (1992) describe the use of activity mapping to address the coordination aspects of related activities for process redesign.

Utilizing ABC attributes with process analysis allows for non-financial measures to be extracted from a specific process. The cost of quality related activities, such as training, re-work, returned goods, and inspection, can be evaluated by the relative cost of securing the current quality level within the process. For example, Parker (1993) used activity costs of quality to evaluate distribution locations. By comparing business process costs by location, varying degrees of quality and cost effectiveness were uncovered. ARCO Alaska (Cooper and Kaplan 1992a) used process analysis to rank functional areas by total cost. It expected to find Accounts Payable as the largest consumer of resources. The ABC data confirmed their hunches about Accounts Payable, however, they were surprised to find out that Administrative Management ranked a close third in total costs.

In contrast to traditional systems, which provide a vertical view of costs, ABC information permits the company to be "viewed horizontally" across functional lines. Business process analysis expands the application of activity cost information to other improvement programs, such as JIT, re-engineering, and TQM. Business process analysis permits operational changes which are more broadly based. For example, business process re-engineering is an improvement technique which looks at the whole firm, and attempts to make significant changes to the work process (Hammer and Champy 1993). Changes could, and should, be made with a more complete picture of how the whole organization works together (Lammert and Ehrsam 1987).

8.10.2 Change through Value Analysis. ABC permits the use of attribute coding to organize and manage non-financial aspects of activities. The most common attribute is the assignment of "value" to each activity. However, in practice, defining an activity along a "value" or "no-value" dichotomy is very difficult and impractical. This is why many firms have adopted a more flexible system which incorporates multiple levels of activity value. For example, Williams Brothers Metals (Cooper and Kaplan 1992a) ranked each activity in terms of their relative contribution to customer perceived value. A number system used a ranking system to add more versatility to the value analysis. However, other companies, such as Kraft USA (Cooper and Kaplan 1992a), found that even ranking activities was too difficult to implement in practice. If value of activities can be reasonably assigned, operational changes could be accomplished based upon important qualitative information as well as upon financial information. Activities which are identified as adding little value to the company mission could be targeted for elimination, or restructured to consume less resources. Activities perceived to add a significant amount of value to the organization could be supported by additional resources to enhance their contribution.

Another attribute used in value analysis is the reason code. It is logical to assume that each activity is performed for a specific purpose. If the activity objective can be clearly identified it can be coded in an ABC system. Hughes Aircraft (Haedicke and Feil 1991) used reason codes such as regulatory, contractual, management request, and business unit request. The analysis revealed that most of the activity costs were due to management and business unit request. Less than a quarter of the costs arose because of contractual or regulatory reasons. Operational changes were made to reduce the burden created by management request. This was accomplished by eliminating a number of financial reports which were never read, and by reducing the extent of formal control which added little value to the corporate mission.

volume which determine cost behaviour are suggested. They are batch related, product related and facility related activities. Understanding how activities affect the levels of cost variation permits management to target their efforts effectively, for example, in the case of Instruments Inc., Foster and Gupta (1990) expected most of the overhead costs to be at the facility level. It was determined that batch level activities were movements or shipments of product to fulfil customer orders. Product-sustaining costs were such things as machine and product maintenance. Facility-sustaining activity costs were related to general maintenance, and support activities which were not customer or product specific. After analysing the activity hierarchy results, it was discovered that 41% of the activities could be controlled and managed at the customer order level. This was significant since it was believed that facility related activity costs were fixed and thus unmanageable in the short-term. Operational changes were made at the batch level by targeting the activities which involved processing customer orders.

8.10.4 Change through cost driver analysis. Cost driver information is perhaps the most tangible facilitator for operational change in an ABC environment. This is because it serves as a denominator for allocating cost burden, and as a measure for monitoring operational changes. As a denominator, cost drivers help to distribute costs among departments, activities, and products (Foster and Gupta 1993). By dividing the total cost by the number of cost driver transactions, a unit cost, expressed in cost driver terms, could be determined. For example, cost could be understood to mean cost per purchase order, cost per engineering change order, and cost per customer order.

At Farrall Inc. (Cooper and Kaplan 1992a) made operational changes based on three cost driver measures. They were the cost of engineering change notices, materials handling moves, and the minimum economic order size. An ABC team determined that engineering costs were driven by three sources: the market, internal ideas, and customer requests. The moves, and the minimum economic order size. An ABC team determined that engineering costs were driven by three sources: the market, internal ideas, and customer requests. The ABC results indicated that customer requests for changes consumed a proportionately high level of engineering resources. The company recognized that part of their market appeal came from providing this flexibility to its customers. Procedural changes were made to evaluate the cost-benefit of changes proposed by customer in the future. Furthermore, other operational changes were made to try to reduce customer change requests by improving communication with customers, and ensuring that project plans are made flexible to permit design alterations to be made at a minimum cost.

8.10.5 Types of operational changes. An ABC system serves as an attention-getting tool to focus management's attention on problem areas of the company (Turney 1992, Merchant and Shields 1993). Unlike some traditional accounting models, such as break-even point analysis and contribution margin analysis, ABC does not necessarily indicate precise courses of action (Salafatinos 1995). Rather, the activity data is intended to give management a perspective on the problem to be joined with managerial judgement and other modes of analysis.

Activity-based information can be used to support a wide variety of operational changes. Below, in figure 8.1, is a chart which summarizes some of the operational changes which have occurred in various case study research. It illustrates the potential range of operational choices with respect to activity information:

CASE NAME	RESEARCHERS	OPERATIONAL CHANGES
Instruments Inc.	Foster and Gupta (1990)	1. Process rates used in design 2. Design changes linked to cost drivers 3. R&D costs matched through activity analysis 4. Monthly reporting of process costs 5. Product mix changes to lower costs 6. Increase in accurate costing of profit centres
Wavering	Friedman and Lyne (1995)	1. Freight is subcontracted 2. Part-time workers are used more effectively 3. Product range discontinued
Kraft	Cooper and Kaplan (1992a)	1. Departmental cost evaluation assignments 2. Transfer pricing using activity data employed 3. Cost reduction effort focused on product line
John Deere	MacArthur, Kaplan (1992)	1. Advanced competitive bidding strategy 2. Expansion of transfer pricing
Hughes Aircraft	Haedicke and Feil (1991)	1. Bottom Up management through ABM
Caterpiller	Jones (1991)	1. Responsibility accounting advanced through ABC 2. Departmental activity budgets formulated
Cellular One	Turney (1992)	1. Changed distribution channels

(figure 8.1)

8.11 CONCLUSION

A cost system, such as ABC, brings with it both intentional and unintentional change. Applying the technical aspects of ABC without consideration of the change process can be very dangerous. A successful ABC cost management project requires both strong project management skills and strong adaptive skills in managing the organizational change process (Cooper and Kaplan 1992a).

The organizational impacts of ABC systems are more pervasive and thus create a stronger impact upon organizational behaviour than conventional costing systems. However, it is possible that traditional techniques exhibited similar appeal when first introduced. Unlike traditional systems, ABC systems are built by a multi-functional team and the information produced is easily understood, communicated, and measured by non-financial managers. ABC cost data ceases to be merely accounting information, but rather organizational knowledge. As mentioned in previous chapters, one standard to judge a cost system is its ability to influence and manage organizational behaviour. Against this standard, ABC offers great potential for management to achieve company objectives. Evidence reviewed above shows the following to be highly instrumental in achieving these objectives: alteration to control systems; cost understanding; decision making; and the use of accounting roles and relationships to influence behaviour. However, with ABC's enhanced and pervasive role as a cost system in an organization, comes the added caution and responsibility needed to plan for and consider the potential organizational effects of operating ABC systems.

In spite of the claims of ABC advocates, and success stories from prior implementation experiences, ABC is not without its limitations. As a final chapter to part one of this thesis, the theoretical and practical limitations of activity information are addressed.

CHAPTER NINE

THEORETICAL AND PRACTICAL LIMITATIONS

9.1 INTRODUCTION

This chapter presents both the theoretical and practical criticism of ABC. As with every new and innovative contribution to a field of knowledge, ABC comes with its critics and advocates. ABC is an evolving management technique which is less then eight years old[1]. Its advocates contribute to its development by conducting case studies and field research which are largely supportive of ABC concepts. Its critics have an important role in the evolutionary development by attacking the weaknesses of the technique and focusing upon areas which may require further research and development.

In recent years there has been a significant amount of attention given to ABC among academics as well as professionals. In case study research and consultancy cases, ABC is credited with outstanding performance improvements in terms of cost and process management. For example:

> "Knowing the cost of high volume parts encouraged Tektronix product designers to use parts that were common to multiple products." (Tektronix International)
> (Turney 1992)

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[1] The origins of the concept extend back well beyond eight years. Indeed, Staubus (1971) referred to activities as a means for understanding costs. However, the most accepted and publicized evolutionary phase of ABC has come about since around 1987 (see chapter one for more information about the origins of ABC).

> "Many of the sites (Case studies) reported that seeing the amount spent on activities stimulated cost reduction and process improvement efforts."
>
> (Cooper and Kaplan 1992a)

ABC adds an interesting dimension to the field of management accounting. The possibilities and applications of ABC are still only just beginning to be explored. Innes and Mitchell (1995) suggest a growing trend in its acceptance and its pervasive application to management accounting problems. However, it is unlikely that any one accounting technique could ever revolutionize an entire body of knowledge, and at the same time render traditional approaches obsolete as Morgan and Bork (1993) and Johnson and Kaplan (1987a) suggest. This is because most new management accounting approaches are built upon older established concepts. For example, the term "cost driver" is a new way of expressing old ideas about cost behaviour. ABC should be evaluated as a new and interesting addition to the field of management accounting, rather than a revolutionary breakthrough. It should also be researched in terms of its potential as well as its shortcomings.

9.2 THEORETICAL CRITICISM

The theoretical criticism of ABC is focused upon the ABC assertion that "activities cause costs". This premise is questioned in six different ways. Firstly, the relevancy of ABC information to manager's needs is questioned. Secondly, an argument is put forward that ABC is not very new, and that it is not unlike other allocation systems. Thirdly, the "concept of usage" is used to portray ABC as just another form of labour rate allocation base. Fourthly, the applicability of activity reporting for short-term decision making is questioned. Fifthly, ABC is criticized on the basis that it encourages inward thinking when the modern competitive environment requires outward strategic awareness. Finally, the logical framework upon which ABC is based is called into question.

9.2.1 ABC relevance. The most critical problem with ABC an system is its failure to establish a systematic link between resource supply and demand. Resource supply is spending manifested as expense categories contained within the general ledger. Resource demand is the consumption of resources by activities (Cooper 1990b). As of yet, no research has established a clear link between the expense levels and activity consumption (Chapter Five). In other words, there is no established computational method by which to estimate the effects of activity usage upon income. There are only vague references which link activity usage rates to long-term growth, productivity, and profits (Johnson and Kaplan 1987b, Johnson 1988, Cooper 1990b). For instance, Cooper and Kaplan (1992b) suggest that resource consumption is related to resource supply by the excess capacity in the system. The equation for this is as follows:

$$\text{COST OF RESOURCES SUPPLIED} = \text{COST OF RESOURCES USED} + \text{COST OF EXCESS CAPACITY}$$

The idea is that activities consume resources without directly affecting resource supply until resource capacity is reached. Resource capacity is expressed as the relationship between an expense level and an activity rate level. Additional supply capacity must be deployed to permit activities to continue to function effectively beyond the initial activity capacity. In a sense, expenses serve as fuel for activity operation. The activity can continue to be performed as long as fuel exists. Once the fuel becomes low, the activity ceases to operate effectively. The stress of a "low fuel" situation is revealed to management by increases in defects, late deliveries, and poor quality (Cooper and Kaplan 1992b). Although this is a plausible conception of the relationship between resource supply and demand, it is unclear how traditionally fixed expenses, such as depreciation and other capital related expenses, fit into this excess capacity equation. Moreover, it has yet to be determined how this equation can assist management in making predictions about costs as a result of activity consumption rate changes. The excess capacity concept provided by Cooper and Kaplan

(1992b) gives a reasonable explanation as to why activity usage rates do not directly influence expense levels. However, this concept fails to explain how activity usage directly affects expenses.

A problem with reporting costs in activity form is that it lacks a connection to net income calculations (Salafatinos 1996). One of the most important established guides to performance, as well as the most influential performance indicator to investors and creditors, is net income. Traditionally, costing systems have been designed to translate management decisions into pro-forma balance sheets and income statements (Burch 1992). Indeed, the standard by which costing systems have been judged depends upon the accuracy of translating management's actions into quantified statements of condition and performance. A cost system which does not meet this standard must be called into question. Unlike traditional methods, such as the contribution margin analysis and cost volume profit analysis, ABC fails to inform management of the quantifiable consequences of its actions. The question is, how useful is a cost system which is unable to inform management how their decisions will effect the levels of assets, expenses and income?

Cooper (1990b) argues that ABC should not be judged upon the logical premise that activities cause costs, but rather upon the relative usefulness of the approach to organizations. It is very difficult to test such ideas in a dynamic and complex environment. The real test for ABC should be how many users adopt it and find it useful for managing costs.

9.2.2 An allocation system. Another criticism of ABC is that it is just a more elaborate allocation system. ABC advocates often refrain from using the word "allocation", replacing it instead with terms such as "traceable" or "driven". This is because the foundation of ABC is supposed to be based upon the premise of cause-and-effect. Products cause activities and activities cause costs. No allocation would ever be necessary if a causal link can be established between costs and activities. However, more often than not, joint and indirect costs are present and therefore some allocation of costs is inevitable (Campi 1992). According to Thomas (1974), all allocation methods distort costs and result in a fictitious cost concept. Given that joint and indirect costs are inevitably present in most companies, all full cost systems, including ABC, must use some level of allocation. Although ABC makes use of cost drivers to approximate resource consumption, the cost driver is unlikely to be unique to every cost in every instance. Noreen (1991) suggests that the costs must be strictly proportional to the cost driver as a condition to ensure ABC provides relevant cost information.

Although it is unclear what criteria should be used to judge the quality of a cost system, one important criterion is consistency. A good cost system should be a faithful measure of the economic reality independent of the system used to organize it. In other words, the cost system applied by different accountants for the same organization should derive approximately the same cost results. The problem with ABC is that it leaves a wide range of possible configurations bounded by little more than a manager's creativity (Friedman and Lyne 1995). This is because, unlike traditional systems, ABC systems are not constructed by a single unified accounting department constrained by traditional technical conventions and standards of conduct. Rather, ABC systems are built by a team of accounting and non-accounting managers as well as consultants. Each member of the ABC implementation team comes to the process with their unique skills, agenda, and perspective of the company. It could be argued that a significant amount of subjectivity also exists in traditional costing systems. However, the possibility of subjectivity is limited by enforcing simple and straightforward generally accepted methods. Traditional costing system standards are much more structured and restrict the opportunity for interpretation. In this respect, ABC systems are likely to be less consistent, and are more susceptible to manipulation. ABC systems can be more destructive to an organization which depends upon objective and reliable cost information than a traditional costing system.

In the last two decades, overhead costs have been rising in proportion to total costs (Johnson and Kaplan 1987a). As overhead costs make up a larger part of the total cost of the product, it is more likely that product cost distortions will exist. Traditional models recognize that a fully absorbed product cost is fictitious (Humphreys and Shaw-Taylor 1992). Given that no concept of "true cost" exists, traditional methods emphasize simplicity and cost effectiveness over accuracy. The simplicity of the allocation process enhances the visibility of product cost components. A manager must be able to understand how costs are derived in order to fully appreciate its components. He must know which can and can not be reliably predicted. ABC systems tend to hide the process of calculation of costs. ABC calculations are complex and require computer power to determine costs. Within this complex and technical process, managers may lose a sense of control over cost composition, limiting their understanding and thus their ability to manage and assess the cost implications to decision making problems (Noreen 1987).

9.2.3 Resource consumption. Another theoretical dilemma that ABC systems face is with "the concept of usage". It is argued that ABC is superior to traditional systems because it uses multiple variation bases (Cooper 1990a). This use of various cost drivers is intended to improve the accuracy of tracing costs to costs objects. ABC recognizes that direct labour is only one of many possible cost drivers linking resources to products. They include the number of purchase orders, the number of invoices, the number of hours, and the number of set ups. Cost drivers could be separated into two categories, transaction-based and time-based.

Transaction-based costs drivers are dependent upon an operational trigger. Operational triggers signal a unit of cost driver has been incurred. The transaction-based cost driver is measured by the number of operational triggers which occur. The number of cost driver triggers are intended to represent the rate of consumption by a given activity of a given resource. For example, consider the activity of processing purchase orders. The rate at which this activity uses resources could be measured by the number of purchase orders processed. The number of purchase orders is the cost driver. Each time a purchase order is produced, it triggers the accumulated measure representing the use of resources by the activity. In other words, every time a purchase order is processed, an increase in usage has been incurred.

Time-based cost drivers are different from transaction-based cost drivers. The activity, measured by time-based cost drivers, is determined by the actual time a human spends performing the activity. Time logs are often used to report the rate of usage for the activity cost calculations. However, time logs require an enormous amount of time and effort to maintain, are susceptible to manipulation, and are not very economical. This is why ABC system implementors often substitute time-based cost drivers with transaction-based drivers. It is believed that transaction-based drivers are simply a convenient cost effective and objective way of expressing time related work.

If transaction-based cost drivers are merely surrogates for time-based drivers, then ABC loses its theoretical justification for its increase in accuracy. The reason ABC is hailed as a more accurate method of tracing costs to products is based on the utilization of multiple cost drivers which possess unique relationships with resources, activities and cost objects. Therefore, if transaction-based cost drivers are merely representations of human time spent, then it is difficult to see how a multiple driver approach adds something new to the accuracy of the allocation. Although it may be argued that certain transactions may be better representations of relevant time, transaction-based drivers suffer from the limitations associated with using surrogates rather than the real time factor it is supposed to represent.

Cooper (1990b) argues that accuracy, in terms of product costs, is a subjective term. The ABC perspective on accuracy is that it is better to be approximately correct than absolutely wrong (Kaplan 1990a). In other words, traditional systems employ an exact method of determining the levels of expenses by using a strict definition of fixed and variable overhead. In contrast, it is difficult to determine the exact effect activity changes will have on resource expenses. Although clear answers can be derived from the traditional methods, they are often flawed with unrealistic assumptions and oversimplification. It is better to use activity data for managing costs because it gives a more realistic, if less clear, indication of cost behaviour.

9.2.4 Short-term decisions. Traditional approaches to short-term decision making are dependent upon a unit-based variable costs concept. Traditional cost accounting offers a clear distinction between variable and fixed costs. Variable costs change in proportion to unit volume production, fixed costs do not. ABC offers no clear cut definition for variable and fixed costs. Instead, it offers a complex hierarchy of variation levels, and an unlimited number of independent variables (cost drivers), in addition to output volume which all impact upon cost variation (Cooper 1990a). Consequently, using ABC information with contribution margin analysis or cost volume profit analysis is problematic. Activity information is designed to measure the rate at which cost objects consume activities and resources. In an ABC environment, therefore, target levels of production volume, unfortunately, do not translate easily into cost predictions. No cost margin, which varies linearly with sales volume, can be derived using ABC information (See Chapter seven for discussion on ABC and short-term decision making).

Cooper and Kaplan (1991a, 1992b) recognize the limitations of ABC for short-term decision making, but stress instead the importance of management focusing on the long-term implications of decisions. Cooper (1990b) states that a common misconception of ABC is that a change in activity can be interpreted as a change in differential costs. ABC was never intended to measure spending, rather it was designed to measure resource consumption.

9.2.5 Internal focus. In recent years there has been a trend for management accounting to focus upon the external environment of the firm (Simonds 1981, Shank and Govindarajan 1989, Bromwich 1990). This view of management accounting is known as Strategic Cost Management. It is a movement which endorses the idea of management accountants collecting, analysing, and reporting on external environmental factors which affect cost and profits (Shank and Govindarajan 1992). Such factors may include competitive and market factors as well as economic and governmental factors. Shank and Govindarajan (1992) suggest that a strategic focus on external factors can help manage the "value chain" of the organization. The "value chain" is a framework for breaking down the basic components of providing value to the end-user (Yoshikawa et al. 1993).

Historically, both ABC and traditional costing systems have been used solely for internal cost management problems. It is argued that ABC encourages an inward orientation ignoring external threats and opportunities which may originate outside the firm (Humphreys and Shaw-Taylor 1992). Bromwich and Bhimani (1989) argue that the trend in pricing should be based on the Japanese model, working backwards from market price to production cost. Target costing is an approach which begins with market analysis determining what bounds of price are appropriate for the intended product. Design and production analysis is then performed to attempt to produce and market the product at the target price. Bromwich and Bhimani (1989) argue that ABC encourages just the opposite approach to pricing. Rather, ABC reinforces the "Cost-Plus" pricing method in which firms price product based on their cost of production. In an increasingly competitive world, such an approach may prove to limit a firm's competitive advantage (Kingcott 1991).

Although ABC is a system primarily designed for managing the internal costs of the organization, this is not to say that activity information can not be used to look outward in a strategic manner. Strategic cost management requires that internal information be matched with the external market to fully comprehend the environment. Activity information, such as quality attributes, clearly affect the extent to which the customer is satisfied and thus influences the position of the firm in the market place.

9.2.6 The logic of ABC. The fundamental theoretical basis for ABC rests with the assertion that activities cause costs. Piper and Walley (1990) argue that this assertion does not stand up to close scrutiny and that it has never been empirically tested or logically established. The ABC assertions could be questioned in two ways. First, there may be more than one factor which causes costs. For example, in addition to activities, decisions, volume, and the passage of time may also create cost. Second, the assertions can be challenged by citing instances where the performance of an activity appears to bear little relationship to cost. For example, it would be logically difficult to define an activity which when performed, could be proportionately linked to a relative increase in factory rent. Although it is difficult to justify logically the ABC assertions, that doesn't mean that activity information is not useful to management. It may be useful to use activities to serve as the basis for costs in a certain situation, or within a specific environmental context (Fox 1991). It is a dangerous assertion for any cost system to promote a single factor as a cause for cost.

> "In the case of costing, the concomitant events are decisions, activity, time and volume and possibly other factors. To choose one factor, as is done with ABC, is to create a logical fiction."
>
> (Piper and Walley 1990)

> "It's important to recognize that one way of seeing is also a way of not seeing."
>
> (Cooper 1983)

In addition to the lack of sound evidence that activities cause costs, the claims that ABC systems result in more accurate product costs can also be questioned. Since there is considerable debate whether a "the true cost" actually exists, it is difficult to accept the ABC claim. ABC advocates often use case study examples of the success gained through the implementation of ABC systems. However, the claims of success are difficult to disentangle from a myriad of factors which contribute to an organization's success. For example, ABC was introduced in the Tektronix Portable Instruments Division (Turney 1992), and was credited with improving the performance of the company. However, after further investigation, it turned out that the change of costing systems was only a small part of the total reorganization going on at the same period of the time[2]. Factors such as corporate policy changes, strategic planning, changes in plant location, the level of capital investment, corporate culture, and the reshuffling of staff all contributed to the improvement in performance.

ABC is often put forward as a revolutionary solution to the problems with traditional cost management. While the ABC assertion that activities cause costs may be a useful tool to help management address overhead allocation problems, it should not necessarily be accepted as the only logical cause for the origination of costs.

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[2] Piper and Walley (1990) analyzed the cases of Tektronix, Siemens Electric Motor and John Deere Computer Works and explicated a number of contributing variables which may have had greater influence on performance than the implementation of ABC systems.

Piper and Walley (1990) argue that decisions may precede activities in causing costs. Cooper (1990b) concedes that decisions do, in fact, precede activities, but suggests that the number of decisions which can be made in an organization is so large that it becomes impossible to report decision relevant cost in an economical manner. ABC can use activities, which are manifestations of decisions, in a highly efficient and practical way.

9.3 PRACTICAL ISSUES

The other dimension upon which to base criticism of ABC is on practical grounds. There are four practical problems associated with the application of its principles. First, some evidence suggests a gap between ABC systems presented in the literature, and those presented in the real world. The second problem is the impact of cost drivers upon consistency of application and behavioural issues. Third, arguments are raised suggesting that no evidence exists which links ABC to improved performance. Finally, ABC systems are attacks on the cost effectiveness of installation and maintenance.

9.3.1 Practical application. One of the main criticisms of ABC is that it really doesn't work very well in practice. The large proportion of fixed and indirect costs which exist in most companies makes the application of ABC principles difficult to implement (Horngren 1990). Much of the ABC literature conveniently uses simplified examples of costs drivers, activities, and tracing paths which require no arbitrary allocation. Indeed, a standard set of activity examples have been developed and repeatedly used in the literature, passing from one publication to the next (Kaplan 1988, Cooper 1990c, Brimson 1991). However, confronted with "non-conforming" activities in real case studies, the ABC model falls short of its "no allocation policy". For example, it is unclear how activities affect such expense categories as depreciation expense. It is often difficult, if not illogical, to construct a cost driver relationship between many fixed costs and activity rates. This could be partly due to the possibility that not all costs are caused by activities as mentioned in the previous section. ABC implementors are consequently forced to apply numerous arbitrary allocations in order to complete the ABC model. Although ABC offers the opportunity for less arbitrary allocation, it is unclear to what extent accuracy is improved.

ABC also offers various attribute coding facilities. The most often used attributes are value or non-value added, and cost of quality. This facility allows ABC users to code activities in terms of their relevant contribution to the cost object and to quality. Attributes help management focus their attention on reducing or eliminating non-value added activities, and supporting or improving value added activities. Using attributes also supports emerging management improvement programs, such as business process re-engineering and bench-marking (Cokins et al. 1993).

The problem with attribute coding is that it is very difficult not only to define the meaning of attributes, but also to get agreement among organizational members as to which activities constitute value added and which do not. The definitions of a value added activity can vary widely. For example;

> "Value-added activity - An activity that is judged to contribute to customer value or satisfies an organizational need."
>
> (CAM-I Draft Document 1990)
>
> "An activity that adds value in the eyes of the customer"
>
> "An activity that is being performed efficiently as possible"
>
> "An activity that supports the primary objective of producing output"
>
> (Cooper and Kaplan 1992a)

Even if a concise definition of value can be formulated, applying value analysis to activities can be problematic. Activities in one department may be considered to add value, while from the perspective of another department, the activity appears not to add value. There is a tendency for a department to consider their own activities prejudicially adding value

(Cooper and Kaplan 1992a).

Walker (1991) identifies three problems with using attributes. The first problem occurs when two or more activities are required to deliver a particular attribute, for example, when the activity of checking product defects and qualifying suppliers are both designed to deliver a quality objective. Also, when a single activity is responsible for two or more attributes. An activity may be designed to support many different products. This may cause the activity to possess different or conflicting attributes. The third problem occurs when a number of different activities form a single value chain. This makes it difficult to exclude a single activity from the group for attribute labelling. Different and conflicting attributes may be assigned to activities in the chain, causing confusion about the nature of the attribute.

Some of the difficulties with attribute coding can be overcome by establishing clear and complete definitions of the attribute. Deciding which activities possess which attribute can be made more efficient by incorporating scales of degrees of attribute variation. For example, in some firms, value added is not forced into a dichotomy of "is" or "is not", rather "high", "medium", and "low" grades of value are assigned to each activity.

9.3.2 Cost driver implications. Using cost drivers in an ABC environment affect the way organizational members think about costs and consequently changes the way they behave.

Cost drivers serve as the link between the monetary element of cost and the performance of the activity. Therefore, once an ABC system is accepted and used to manage costs, the cost driver becomes the focus point for evaluating and controlling cost behaviour. Thus cost drivers serve a powerful role in influencing the way management approaches decision problems. As Cooper (1989a) suggests, the accuracy of an ABC system depends upon the cost drivers selected. Cost drivers which are not consistent from period to period, may cause distortion of the cost of activities and cost objects. Maintaining consistency with cost drivers is difficult because drivers are intended to represent the level of activity consumption of resources. In a changing organizational environment, activities and processes are likely to be dynamic, offering the possibility of driver inconsistency over time.

Although cost drivers are intended to represent the rate at which activities consume resources, conflict may occur when the behavioural implications are considered. For example, suppose the best measure of resource consumption for the activity of processing purchase orders is the number of purchase orders produced. The purchase order department may feel that their performance will be elevated by cost per unit of cost driver. This may prompt the purchasing department to reduce the number of purchase orders by ordering from suppliers less often with larger quantities. This is likely to have a negative effect resulting in increases in inventory levels. Therefore, the ABC designers must balance some degree of accuracy with the behavioural implications.

9.3.3 Profitability. Cost systems are intended to provide management with accurate and timely information for one purpose. This purpose is to maximize performance and profits. As argued by Innes and Mitchell (1990b) and Bromwich and Bhimani (1994), it is difficult to determine if there is a causal link between activity techniques and performance. Proving how much any cost system contributes to the overall performance of a company is very difficult, if not impossible. Separating the cost system from all the other variables which affect a company's performance makes it rather difficult to assess the worth of one system against another. Although ABC advocates make profound claims of the benefits derived from ABC and point to case study evidence to support such claims, it is difficult to judge the quality of such evidence.

Cooper (1990b) agrees that the degree in which a cost system contributes to profitability is difficult to disentangle from other factors affecting the organization. For one thing, no cost system can improve performance unless decisions are actually made based on the information provided by the system. The extent to which ABC facilitates the managing of costs and processes could only be evaluated by the testimony and reflections of the organizations which have used it.

9.3.4 Cost-benefit. Finally, the last practical problem ABC systems face is the extensive cost of implementation. Traditional costing systems are simple and relatively easy to implement. The most simple application of traditional cost systems can be implemented by a single accountant in very short period of time. This can be accomplished by selecting an appropriate allocation base, such as direct labour, and dividing all fixed costs by this base. In contrast, ABC systems require enormous amounts of time and resources to implement. Whole teams of managers are normally required to meet frequently over a long period of time. Computer and software resources must also be acquired and engaged. Top management can only commit its leadership capital to a limited number of key success factors and requires top management to expend its limited leadership capital. Once the ABC implementation is complete, the cost of maintaining the system continues indefinitely. The cost of implementation and maintenance must be balanced against the expected benefits.

Companies with simple product structures and a limited production process may find that the ABC cost information is not significantly different from the old traditional system. In this case, the cost of implementing an ABC may not be cost effective. On the other hand, organizations with a wide product mix and a complex production process may find the new information very different from the previous system. Although the results are likely to be significantly different, in this case, it remains unclear whether the results are in fact superior.

9.4 CONCLUSION

As outlined above, ABC can be criticized both in theoretical and practical terms. Whether ABC can withstand this criticism over time is not yet clear. However, what is clear is that ABC should not be judged against the standard set by most ABC advocates. That is, ABC should not be trumpeted as a revolutionary approach to management, rendering all traditional techniques obsolete. No new costing system could meet this standard. Rather, new costing techniques should be judged on the basis of how useful it is to management. Cooper (1990b) acknowledges that no scientific empirical test could ever be applied to cost systems in a complex organizational environment. However, Cooper (1990b) argues that the ultimate test for ABC logic lies in how many firms adopt and derive benefits from it.

CHAPTER TEN

CONCLUSION TO PART ONE

10.1 INTRODUCTION

This chapter draws some conclusions from Part 1 of this thesis as a prelude to the research case study that follows in Part 2. From the preceding review of the literature one could reasonably conclude that ABC is already an interesting and significant development for both management and management accounting. This is evidenced by the proliferation of ABC research found in academic and professional publications, the growth of consultancy firms offering implementation services, and the emergence of ABC concepts in educational text books (Chapter 2). In addition, surveys and field studies confirm an extensive practical interest in ABC even though adoption remains relatively cautious (Innes and Mitchell 1991a, 1995) (Chapter 6). However, the literature analysis invites the following observations to be made on the current status of ABC which reflects both interest and caution:

1. ABC is an important addition to the practice of management accounting.
2. There is a theoretical framework to support ABC.
3. ABC is widely applied to many areas of management accounting.
4. Established techniques and methods can be integrated with activity information.
5. There are significant practical problems with implementing ABC.
6. The implementation of ABC is highly dependent upon organizational and behavioural considerations.
7. More research is needed.

10.2 ABC IS IMPORTANT

ABC is important because it is perceived by many businesses to be a viable solution to the deficiencies of traditional approaches. Many companies have experienced a rise in overhead costs relative to total costs, and as a result have become more concerned about managing and controlling these costs (Johnson and Kaplan 1987a). ABC offers management a system which can be used to visualize the behaviour patterns of overhead costs, and the opportunity to connect management action to economic consequences. Thus, ABC is a research topic which firms can actually operationalize. The innovation of ABC is similar to other innovations of the past, such as the Discounted Cash Flow (DCF) method of decision making and the Return on Investment (ROI) method of performance measurement which have a practical orientation and allow companies to "try them out" to see if any benefit may be gained from their use (Kasanen et al. 1993). This ability to operationalize ABC underscores the practical importance to consultancy and business.

10.3 ABC IS THEORETICALLY BASED

As described in Chapter 2, ABC is more than just a practical approach to cost management, rather it is a "theory of cost behaviour" upon which management control practices can be formulated. It is a theory which attempts to capture the essence of the natural inputs and outputs of an organization (Staubus 1990). The theory that products cause activities and activities cause costs can serve as a basis for prescribing management control policies. Management can therefore control organizational costs by managing the activities in the organization (Cooper 1988a). A traditional cost management approach encourages management to focus on managing line items on the financial reports. In contrast, ABC directs management's attention to managing activities as a means to controlling costs (Johnson 1988).

10.4 ABC IS APPLICABLE TO MANY AREAS OF MANAGEMENT ACCOUNTING

In Chapter 6 it was argued that activity information could be applied to a wide range of management accounting problems. Mitchell (1994a) concludes that ABC may potentially be suitable for inventory valuation, decision support, costs control, budgeting, and performance measurement. In addition, Bellis-Jones (1989) suggests that ABC could be applied in a strategic manner to external factors such as customer profitability.

10.5 ABC CAN BE INTEGRATED WITH ESTABLISHED METHODS

As Chapter 7 suggests, activity information could be used to modify contribution analysis and could be integrated with the application of the Theory of Constraints (TOC) (Salafatinos 1995). ABC permits the inclusion of qualitative data into traditional quantitative models through attribute coding. In addition, in Chapter 7 Cooper's (1990a) cost hierarchy expanded the view of cost variability, which enhances contribution margin reporting. Indeed, even TOC, which is viewed by many (Darlington et al. 1992) as completely contradictory to ABC, could be integrated using activity maps (Morrow and Hazell 1992) (Chapter 7). Yet Chapter 5 pointed out that ABC systems and traditional ledger systems measure different aspects of costs, which required reconciliation. According to Cooper and Kaplan (1992b), ledger systems measure resource supply while ABC systems measure resource demand. In order to predict fully the economic consequences of management action, <u>demand</u> information needed to be reconciled with <u>supply</u> information (Chapter 5).

10.6 IMPLEMENTATION IS COMPLEX AND PROBLEMATIC

Implementing a complex new cost management system into an equally complex business environment leaves room for a wide range of approaches. The ABC calculative structure requires complex calculations for tracing costs from the ledger to products or services. It requires many steps, and involves numerous layers of allocation (Chapter 3). In addition, there are a number of different implementation paths, each resulting in unique set of costs and benefits.

ABC is criticized both on theoretical and practical grounds. As Chapter 9 pointed out, there are strict preconditions by which ABC can be considered economically sound (Noreen 1991). Indeed, Piper and Walley (1990) question the very logic of ABC theory itself by suggesting that decisions rather than activities cause costs. In terms of practical problems, Horngren (1990) gives an example of ABC failure simply because it is too complicated. In Chapter 9, Cobb et al. (1992) argued that the problem with ABC is that it is too historical, it continues to use arbitrary allocations, and costs too much to implement. Finally, Chapter 9 argued that there is little evidence which links ABC to improved performance.

10.7 IMPLEMENTATION IS DEPENDENT ON ORGANIZATIONAL FACTORS

As Chapter 4 illustrated, constructing an ABC system requires more than simply making technical alterations to the management accounting system. Accounting systems are socio-technical in nature, and as Shields (1995) suggests, changing an existing costing system requires consideration of the organization's culture, management commitment, change-agent leadership, controls, and continuous education.

Bhimani and Piggot (1992a) suggest that ABC's technical impact gives rise to a wider level of organizational repercussions which may not necessarily be predictable. These are changes in organizational culture, power and responsibility, and organizational member roles. Chapter 8 pointed out that the process of organizational change is an important aspect of implementing ABC, which was supported by Innes and Mitchell's (1990a) use of contingency theory to identify the underlying forces which shows the impact of the way accounting evolves within the organization.

10.8 MORE RESEARCH IS NEEDED

The literature suggests that ABC is still an evolving management accounting innovation which requires further research. This is particularly apparent concerning issues of implementation and the process of change. Although there have been a number of studies investigating the operational and methodological issues surrounding ABC (Johnson 1987, Cooper 1988b, Cooper and Kaplan 1991b, Brimson 1991), much less is known about the process of change with regard to implementing new knowledge systems (Argyris and Kaplan 1994). The management of the change process focuses on overcoming barriers to implement new ideas and practices.

Several articles in the mid-1980's (Kaplan 1983, 1986a, Bruns and Kaplan 1991) advocated that management accounting researchers concentrate more on field studies to understand accounting phenomena. Kaplan (1993) argues that empirical analysis of large data sets and cross-functional field research are suitable for understanding the "what is". However, these methods are less helpful for understanding dynamic structural changes which occur in organizations, and uncovering the "what's new" and the "what is to be" (Kaplan 1993).

The above literature review suggests a number of questions to be answered. These include:

1. How does an organization obtain knowledge of a new technique such as ABC and make use of accounting literature when implementing it?
2. What technical and organizational problems, and solutions arise from implementation?
3. To what extent does the change process need to be considered when implementing ABC?
4. What drives the change process, and how does it progress within the organizational context?

Part 2 of this thesis (Chapter 11 through 14) follows, and reports the research methodology and results of the case study designed to investigate the implementation of ABC at Calor Gas in order to find some answers to the questions raised above.

PART TWO:

THE CASE STUDY OF CALOR GAS

The purpose of Part 2 of this thesis is to describe the nature, content, and purpose of the case study, and to report the research results. Chapter eleven outlines the methodology, the aims, and the relevant research questions of this thesis. In addition, background is provided about the research site and the implementation process. The results of the research are presented in chapters twelve and thirteen. Chapter twelve presents the technical problems that occurred during implementation, and suggests conceptual models for solving them. Chapter thirteen reports the organizational change process which occurred during implementation, and suggests an "evolutionary" model of the process of change. Chapter fourteen summarizes the thesis, offers insight into the implications of the results, and suggests possible avenues for future research.

CHAPTER ELEVEN

METHODOLOGY

11.1 INTRODUCTION

By now there have been many published empirical studies about the implementation of Activity-Based Costing (ABC) (Jeans and Morrow 1989, Foster and Gupta 1990, Eiler and Campi 1990, Innes and Mitchell 1990c, Baily 1991, Brimson 1991, Cummings 1991, Cooper and Kaplan 1992a, Bhimani and Pigott 1992a). However, none of these have used the particular approach adopted in this thesis to capture and analyze data. Further, earlier studies are predominantly approached from the perspective of an "outsider" peering into the firm (Covaleski and Dirsmith 1990a). Indeed, few accounting researchers have approached case studies from an "insider" perspective and as a consequence, research results have the potential to become "sanitised" when the research process is removed from everyday accounting reality (Abdel-Khalik and Ajinkya 1983). Case study researchers normally collect data from the organisation by making periodic visits, observing personnel, conducting interviews and questionnaires, and analysing relevant documentation. They probe the organisation at various points to see if interesting things can be learned (Tiessen and Waterhouse 1983). Where, when, and how the probe is placed determines, to a large extent, what is learned or uncovered in the organisation (Bryman 1991).

Case study research from a participant observation perspective can offer a great deal to facilitate the understanding of accounting phenomena within the organisation. Johnson and Kaplan (1987) emphasise the importance of researchers directly entering the business arena to conduct empirical studies. Accounting techniques operate within an organisation and need to be understood, not only in terms of economic implications, but as a social phenomenon which is dynamically integrated within the business organization (Scapens 1990). Tomkins and Groves (1983) also give considerable attention and encouragement to researchers to adopt a "naturalistic style" to aid the understanding of the complex dimensions of accounting phenomena in the organizational setting. The "naturalistic style" is sometimes referred to as grounded theory (Glaser and Strauss 1967a). It permits the researcher to enter the field of study without constructing a formal hypothesis and isolating a limited number of dependent and independent variables from the organisation.

The grounded theory approach was applied in this case study to allow the researcher the flexibility to become engaged in the ABC implementation process and to study the events directly as they unfolded. Understanding was thus gained primarily from "doing" or participating as opposed to merely observing. Therefore, the research data could be collected first hand in contrast to a reliance exclusively on retrospective techniques such as interviews and questionnaires.

The aim of this research was not to assess the usefulness of ABC information, nor to evaluate the cost implications of ABC, rather it was an attempt to investigate practical problems associated with implementing ABC, and suggest means of solving them. The results of this thesis are structured in the following manner. First, the constructive approach and the grounded theory technique are introduced as part of the research methodology. This is followed by a description of the research site and an outline of the implementation process. In Chapter 12 the research results are presented in the form of three specific implementation problems. Each problem is disclosed as it occurred in the context of the case, followed by the presentation of conceptual models in more general terms as they may be applicable to other companies implementing ABC. It concludes with a number of hypotheses "grounded" in the case study that could be tested in future research. Chapter 13 then offers a model of the organizational change process which is depicted as an "evolutionary" form of development. The development of the theory is illustrated through the application of grounded theory coding procedures. Hypotheses are also developed.

11.2 RESEARCH METHODOLOGY

The purpose of this research was to uncover practical implementation problems with ABC and to construct conceptual models which can be applied more generally in other cases. Two approaches to research have been used to form the methodological stance. First, the constructive approach (Kasanen et al. 1993) provides the framework for establishing the direction of the research. Second, the grounded theory approach which was used to provide a systematic method for collecting and analysing qualitative data and to provide flexibility to participate and engage in the implementation process in order to build theory from the case data.

11.2.1 Constructive approach. The aims of this thesis are consistent with the constructive approach described by Kasanen et al. (1993). The constructive approach is a style of research which is directed at managerial problem-solving through the construction of models, diagrams, plans and the development of methods, techniques, routines, and procedures (Kasanen et al. 1993). Examples of managerial constructions include: the Discounted Cash Flow (DCF) method for capital budgeting decisions, Just-in-Time inventory systems, Material Requirement Planning (MRP) models, ABC systems, and the Return-on-Investment (ROI) measure of performance. The constructive approach is also consistent with Kaplan's (1993) new research agenda which suggests that management accounting research should focus more on <u>design</u> and less on <u>analysis</u>. Its underlying rationale is that business research should strive to provide guidance and solutions to common business problems. Similarly, Kaplan suggests that academics should be interested in how to design and implement new technical theories.

> "Management accounting research should be more like *engineering* and less like *science*. We should take basic principles and apply them to the new environment in which management accounting is being practiced."
>
> (Kaplan 1993)

Kaplan's new research agenda and Kasanen's constructive approach require a research technique which permits the researcher to gain an understanding of the problems and concerns from the perspective of the case participants and to facilitate in the development of workable solutions. Grounded theory permits the achievement of these objectives.

11.2.2 Grounded theory. Grounded theory research is a "naturalistic style" of research which is both exploratory and qualitative and is designed to generate rather than test theory. Using this approach, data collection, analysis and theory stand in reciprocal relationship with each other. One does not begin with a hypothesis which is tested. Rather, one begins with an area of study to allow relevant hypotheses to emerge (Eisenhardt 1989). Therefore, the purpose of grounded theory is to build theory that is representative of the reality under study and to formulate hypotheses that can be tested in future research.

Grounded theory originated with the classic work of Glaser and Strauss (1967a). More recently, Strauss and Corbin (1990) have outlined a prescribed formula for building theory which involves specific coding procedures[1]. Both approaches emphasise the importance of allowing phenomena to emerge from the data, though Glaser (1992) argues that they differ with respect to *when* a phenomenon should be identified. He suggests that one should select a research site before committing to a specific area of interest. This is in contrast to Strauss and Corbin's (1990) view that requires the researcher to first possess "theoretical sensitivity"[2] about the subject under study, and hence commit to a specific research problem prior to selecting the research site (Parker and Roffey 1993).

---

[1] The procedures prescribed by Strauss and Corbin (1990) are primarily composed of three types of coding techniques. They are open coding, axial coding, and selective coding. Each technique is applied to the case data to develop relevant concepts that are used to construct the models presented in the results chapters of this thesis. An illustration of how this procedure was applied to generate the results is provided at the end of chapters twelve and thirteen.

[2] Theoretical sensitivity refers to the researcher's ability to give meaning to the data and the capacity to determine what-is and what-is-not important (Strauss and Corbin 1990).

The approach adopted in this study is consistent with the Strauss and Corbin (1990) approach in two respects. First, it employs their specific coding procedures to formulate theory, and second, the researcher targeted a specific problem to be studied prior to selecting the research site. However, because the coding procedures were primarily designed to study behavioural and social phenomena (see Charmaz 1983, Miles and Huberman 1984, Harris and Sutton 1986, Eisenhardt and Bourgeois 1988), certain modifications were necessary to adapt them for researching technical innovation. Normally, grounded theory coding labels are identified directly from observing case participants and events. In this case study, observing a phenomenon was insufficient for identifying codes. The data had to be processed further, analysing and reflecting upon observed events, to translate them into technical concepts. Therefore, codes were identified by the researcher by means of engaging in model-building exercises, debates and discussions with the case participants. This post-analytical interchange between the researcher and key case participants was necessary to bring to the surface technical innovation which lay beyond the mere observation of events. Only after such supplementary interaction could coding labels be identified.

11.3 THE RESEARCH SITE

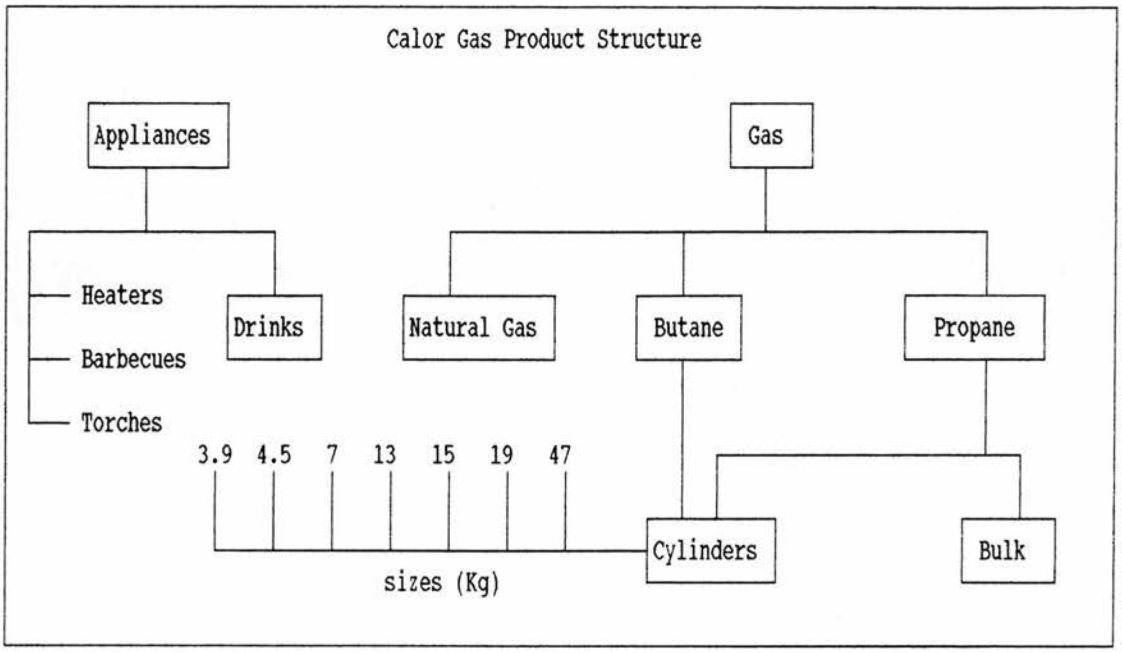
The Calor Gas Scotland regional office in Grangemouth is where the research was conducted. Successful implementation of ABC at the regional level was expected to be adopted later at the corporate level.

Calor Gas was formed in 1935 as a distributor of Liquid Petroleum Gas (LPG). It buys butane and propane gas mainly from British Petroleum (BP) and sells it to customers in various size cylinders ranging from 3.9Kg to 47Kg using a number of distribution channels. Bulk containers are also installed and filled directly to end-users on a long-term contractual basis. The market is broken down by system of distribution (bulk and cylinder) and by end-user-type (domestic and commercial). Butane is more associated with small cylinder distribution and domestic users, while propane is sold primarily through larger cylinders and bulk tanks to commercial customers.

Calor Gas currently has approximately a 50% share of the LPG market in the UK equal to 1.2 million tonnes a year. The industrial market declined in the early 1980's because of the recession and has not yet fully recovered. The domestic market is used primarily for cooking, water and space heating. Cylinder sales are the major source of demand for this market although bulk tanks installed on customer premises have been increasingly used for central heating.

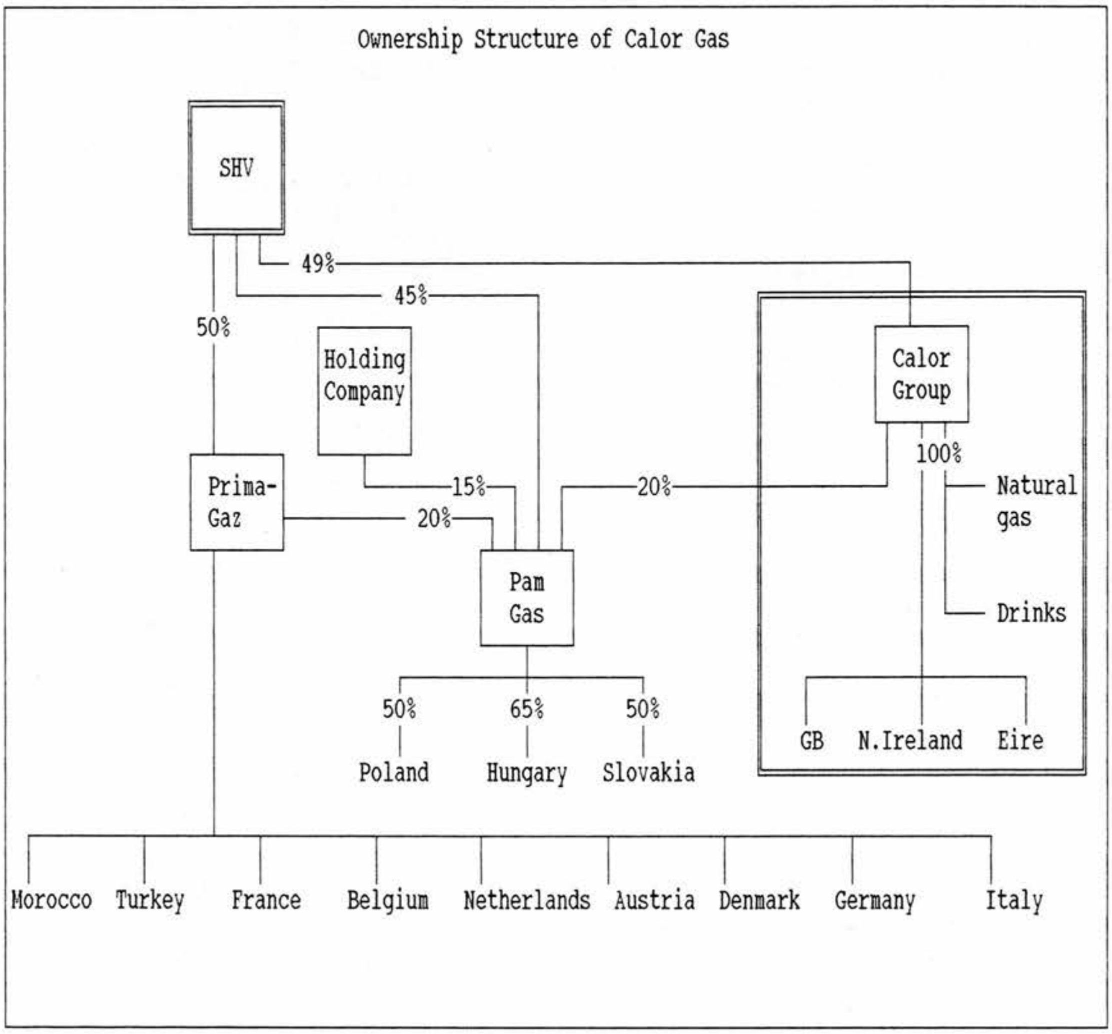
The *cylinder-butane* market is the most profitable part of the business but it is also very sensitive to weather fluctuations. The *domestic-heating* market is in a state of full decline as more and more homes are hooked-up to main line gas. This decline was accelerated by privatisation efforts of government and industry. The *commercial* market currently accounts for about one third of all LPG sales compared to a half 10 years ago. The commercial market consists mainly of cylinder propane and commercial bulk used for space heating, agriculture, industrial processing and engine fuel.

Calor buys butane and propane gas mainly from BP. A permanent pipeline is used to transport the gas directly from the BP refinery to Calor's holding tanks at the filling plant. A very small part of Calor's business is the distribution of gas related appliances, mainly barbecues and home heaters. As of February 1994, Calor became a distributor of natural gas. The product structure of Calor Gas is presented in figure 11.1:



(Figure 11.1)

SHV, a Dutch company, is the controlling shareholder of Calor Group. SHV also owns Prima-Gaz and Pam Gas. Calor has a 20% interest in Pam Gas. Prima-Gaz owns a 20% stake in Pam Gas and also has operations in seven western European countries, Africa and the Middle East. Pam Gas operates in the Eastern European countries and the Calor Group operates primarily in Britain and Ireland. Figure 11.2 diagrams the ownership links of SHV, Prima-Gaz, Pam Gas and Calor Group:



(Figure 11.2)

There are approximately 70 companies competing in the LPG market in the UK. Recently, increasingly competitive pricing has made it difficult for small operators (1% to 2% market share) and many have been withdrawing from the business. Medium size competitors have the potential to undercut Calor Gas on price because of lower overhead costs associated with very limited geographical coverage and by concentrating on cheaper distribution networks.

In 1992 the company underwent major restructuring. Loss in market share, increased competition, and rising overhead costs forced management to reduce the number of employees from 3400 to just 2,102. Overhead costs were reduced from £14.8 million to £11.4 million. Despite a loss in market share over the last 10 years Calor Gas has remained a strong and profitable company. Management has made significant efforts to reduce costs and improve quality to the customer. It has been awarded a BS5750 quality certificate and an Investment In People (IIP) certificate.

Over the last 10 years, Calor Gas sales have been around £300 million per year with 98% of all sales from LPG distribution. Sales fell significantly in 1991 due to the fall of prices after the Gulf War. Operating costs rose steadily from 1984 to 1990, then fell from £74 million to about £51 million as a result of restructuring. Operating expenses average about 60%, cost of gas 54%, and employee costs 35% of sales. After tax profits remain strong at around £33 million.

There has been a strong drive to lower operating costs since 1990. The impact is reflected in employee costs falling from £71 million in 1990 to just £50 million in 1993. The work force, which is no longer unionised, has become more flexible with the use of contract labour. This allows employee costs to increase in the winter cold months and fall back in the warm summer months.

The decision to implement ABC was based upon the Regional Controller (RC) and the Systems/Management Accountant's (SMA) interest in calculating more accurate product costs, providing a more structured and systematic method to improve operations and a more rational approach to future restructuring. It was believed that the restructuring that occurred in 1992 could have been more effective if ABC information had been available. The large cut in the work force was a bitter experience and provided the impetus for investigating the potential benefits of an ABC system. The RC wanted a system which could provide information to management regarding cost reduction opportunities without having to rely on simply laying-off personnel. It was believed that an ABC system could have helped to reduce costs in a much more productive manner. Calor Gas also wanted to use ABC information for decision-making regarding special tank installation jobs and for formulating competitive pricing strategies. In addition, it wanted to have profitability information with regard to specific distribution channels and customers. Unfortunately there was no current comprehensive cost system in place which could support these aims. The RC commented:

> "Eliminating head count is a quick way of reducing costs, but it may not be the most effective way. I'm hoping that ABC will give us the information to be able to control and reduce costs in an intelligent way the next time."

The Calor Gas implementation team considered two ABC software packages, Easy ABC and ABC Power. Easy ABC is produced by an American company called ABC Technologies. ABC Power is produced by Armstrong Laing plc. which is a UK company. Both companies had an opportunity to present their package to the implementation team. Although Easy ABC was the more widely used package, ABC Power was selected because Armstrong Laing seemed to offer better support. For example, they offered a 24-hour "help line" to its customers. The purchase of ABC software was an important part of the implementation process because it provided new insight and direction for the construction of the ABC model. It did this by first offering a structured approach to building the system, and second by giving the implementation team a central place to store and evaluate collected data. Also, the possession of an established tool designed specifically for developing an ABC system gave the implementation team a certain degree of confidence.

Armstrong Laing arranged for two in-house training sessions to introduce the product to the ABC team and to give them practical experience in developing a computer model. The purpose of the first session was to give the SMA (and this researcher) the opportunity to understand the software package and to design a suitable training session for the rest of the team. The second session involved all of the team members engaged in a mock model-building exercise.

11.4 THE STUDY

In February 1994, Calor Gas decided to implement an ABC system. Due to Calor's lack of experience with ABC and the absence of business consultancy involvement in the project, this researcher was invited to join the project to serve primarily as a researcher but also as a member of the implementation team. The RC believed that this researcher's familiarity with ABC literature and academic interest in the subject would be a valuable asset to the project. Consequently, complete access was granted by the issuing of an *employee name-plate* which allowed for unescorted and unannounced visits and permitted data to be collected first hand. The implementation team consisted of 10 managers from five areas of the company including finance, production, marketing, data processing and general administration. The team members were chosen on the basis of their analytical skills, functional area of responsibility and their propensity to be open to new ideas.

The case study took place over a 15-month period beginning with the decision to implement ABC and ending with the completion of the project. Because the research was conducted by a single researcher and he was actively involved in the implementation process, each meeting, interview, and discussion was tape recorded and transcribed. Grounded theory coding labels were identified, concurrently as events unfolded, upon review of transcribed notes, and during private reflection and analysis of the data.

Data was collected in three stages. The first stage was a background and fact-gathering process to understand the basics of the gas distribution business. This was accomplished by going on a company tour, reviewing financial reports, and conducting semi-structured interviews with key functional managers. The second stage of the research involved collecting data by engaging in the implementation process itself. This was accomplished by going to meetings, reading documents, discussing avenues for addressing various implementation issues with the RC and the SMA, and gathering data for the new system. The third stage consisted of applying the grounded theory coding procedures to the data and formulating hypotheses to be used in the construction of conceptual models.

Although several interviews were conducted, most of the data was collected by participating in implementation team meetings which involved planning courses of action, analysing and debating issues, and identifying and developing solutions. This required an enormous amount of time on the part of the researcher. During the period of study there were 24 weekly team meetings each lasting 3 to 4 hours supplemented by 49 telephone discussions with key personnel. The portfolio of case data collected is summarized as follows:

QTY	DATA TYPE
1	Company tour
4	Formal presentations
10	Semi-structured interviews
7	Coded note summaries
24	Meetings
50	Memos
49	Telephone conversations
4	Special task visits

(see appendix for table of sources of evidence)

11.5 RESEARCH LIMITATIONS

Three aspects of the research method employed represent limitations against which the results should be considered. First, the researcher was engaged in the implementation process which significantly influenced the phenomenon under study. A certain amount of objectivity and independence was consequently sacrificed in order to gain unrestricted access and to study the research environment first hand. Because understanding of the phenomenon came primarily from "doing" as opposed to passively "observing", the research resembles a form of action research (Bryman 1988). However, unlike action research, this researcher did not initiate the implementation project, was not required to fulfil certain specified criteria, and did not have a personal interest in ensuring the success of the project (Yin 1984).

Second, the grounded theory procedures allowed for a considerable amount of judgement on the part of the researcher. Identifying coding labels proved to be a subjective process and therefore the research results depended greatly on the interpretation of the researcher. Simply changing the names of the labels and attaching different properties and dimensions may result in different conclusions about what happened in the case. This is why it was necessary to continuously confirm the developing theory with the case participants. In addition, the standard coding process prescribed by Strauss and Corbin (1990) required significant modifications in order to be adapted to the research environment. The coding process was modified by substituting *observation* as the main basis for identifying code names with *interactive dialogue* with case participants as a basis. In contrast to the traditional application of grounded theory, codes were formulated by goal-oriented engagement and problem-solving rather than through passive identification.

Third, the singularity of the study raises the usual limits on the generalisability of the results.

11.6 WHY GROUNDED THEORY?

The legitimacy of qualitative research, such as grounded theory, has been a subject of debate for a number of years (Abdel-Khalik and Ajinkya 1983, Tomkins and Groves 1983). Criticism centres around the lack of scientific rigour and the absence of theory verification in qualitative research. Dent (1991) argues that although these differences are unlikely to be resolved, there are grounds for evaluating the status of this kind of research and some justification for its use.

> "Qualitative inquiry is conducive to a richer appreciation of the way in which control systems may be implemented in action and behaviour, and allows interesting process issues to emerge."
>
> (Dent 1986).

Glaser and Strauss's (1967a) intention in formulating grounded theory was to encourage researchers to gather and analyze qualitative data without being inhibited by the traditional scientific view that a theoretical hypothesis must be formulated as an absolute precondition for carrying out research (Bryman 1988). Indeed, "The Discovery of Grounded Theory" was an attempt to give qualitative researchers a methodological text to cite when they submitted research papers (Glaser and Strauss 1967a).

> "As a system designed, implemented and maintained by humans, accounting and its impact on humans themselves can only be fully understood if examined through an understanding of human behaviour, beliefs, values, perceptions, attitudes and motivations within the relevant social, political, economic and cultural context."
>
> (Parker and Roffey 1993).

Parker and Roffey identified a void in modern accounting research which is detached from the complex social conditions in which accounting phenomena exist. Grounded theory can fill this void with respect to situational complexity. Because of the flexible and inductive nature of the methodology, it can cope with more complex data and multiple variables found in business organizations (Charmaz 1983) than quantitative research, which is based on statistical analysis and is restricted to a few variables in a limited and controlled setting (Tesch 1989). Grounded theory, as an interpretive approach, does not seek to control the phenomena, but aims to enrich our understanding of the meanings inherent in the actions of the organization and its participants. Cooper (1983) considers that the organization in its dynamic dimension consists of conflicting environmental demands. The argument is that accountants are imbedded in a process of reality construction because they provide a language and a process by which things become known. The recognition of accounting as ultimately subjective in nature means that an interpretive style of accounting research is an appropriate one.

11.7 WHY A CASE STUDY?

The case study comprises the research method in this thesis and provides the context by which to study the implementation of ABC. Scapens and Roberts (1993) used a case study for similar research investigating the resistance to accounting change. They advocate the use of the case study domain as an exploratory and explanatory tool to understand the complex web of social reality which surrounds accounting change. Their paper illustrated how the process of change creates conditions which resist accounting change. Indeed, Scapens (1990) states;

> "They (case studies) are fundamental to the development of exploratory theories in management accounting practice."

Moreover, Scapens argues that case studies are better suited for hypothesis-generation than hypothesis testing, and that case studies engender a more accurate method of modelling and theory building.

The case study domain allows the researcher to explore the accounting and change process in a single organization over an extended period of time (Dixon and Bouma 1987). Research data is found in the observable events, the actions as well as the economic and social conditions which interact with the organization (Kaplan 1986a). Participant action, the market, financial information, and other factors create a research environment where research data is changing continuously. These conditions make control over the research design very limited. The researcher has a limited ability to isolate variables, and manipulate them in a specified way in order to study the causal relationships among selected variables. As events unfolded at Calor Gas, the research adapted to the dynamic conditions and developments as they occurred. There was little opportunity for significant advance planning, or for manipulating the research setting. According to Scapens (1990);

> "Case studies offers the possibility of understanding the nature of management accounting in practice: both in terms of the techniques, procedures, systems, etc. which are used and the way in which they are used."

A single case study of Calor Gas provides the organizational context for the implementation of ABC. There are several reasons for a single case approach. A single case provides the researcher with the opportunity to become intimate with the case under study by observing the changes that occur over an extended period of time. An in-depth analysis of a single case may represent a significant contribution to knowledge and theory building. Such a study may even help to refocus future investigations.

There are only two criteria used in the selection of the case. The first criterion required the company to be in the process of, or commencing implementation of ABC. The second criterion is that there must have been sufficient access afforded to the researcher to observe the organization and its changes. The Calor Gas case presented itself to the researcher when the SMA of Calor Gas sought help from the University of Edinburgh in the implementation of their ABC project.

11.8 SAMPLING

With quantitative research, statistics and randomization procedures are used to identify a sample which is a reasonable representation of the population. With grounded theory this issue is handled differently. Sampling with grounded theory is concerned with conceptual rather than numerical representativeness. An event phenomenon is selected based on its significance and relevance to the core category. A core category is the central phenomenon around which all the other categories interact. The researcher is searching for events and incidents that are indicative of the phenomenon. The core category in this case study is the technical change process of implementing ABC at Calor Gas. Counting individuals or events in order to gain a representative sample is therefore inappropriate. Naturally, the more interviews, observations, and documents obtained, the greater the contribution to the density of the theory and therefore this researcher was concerned with numerical sampling to this way.

11.9 THEORY GENERATION

According to Eisenhardt (1989), theory is generated by finding order and meaning in the relevant concepts as they relate to the conditions and consequences discovered in the research process. In this case study, the focus is on technical change. A theory about the change process involved with the implementation of ABC is constructed by developing a "story line"[3] about the case. A "story line" is a grounded theory technique describing (in narrative form) the central phenomenon. This is accomplished by relating categories to the core category at the dimensional level. In this thesis, the provisional core category is technical change. Some properties of change and their dimensional ranges are shown below as an illustration:

Properties	Dimensional Ranges
rate	fast to slow
occurrence	planned to unplanned
shape	orderly to random progressive to nonprogressive
direction	forward to backward upward to downward
scope	wide to narrow
degree of impact	great to small
ability to control	high to low

(Strauss and Corbin 1990)

[3] The term "story line" is used by Strauss and Corbin (1990) to describe a technique for conceptualizing and clarifying the core research category.

The properties of "change" were related to the set of conditions or causes, the strategies and methods, the context, and the consequences of categories identified in the coding process.

11.10 THEORY EVALUATION

Qualitative research is often criticized for its lack of scientific rigour. According to Sandelowski (1986), this is because qualitative research is often judged on quantitative research criteria. She argues that each research method needs its own rules concerning aims, evidence, inference, and verification. Morgan (1983) argues that applying the criteria of one research method against another leads inevitably to bias in favour of the research method for which the rules were designed. Guba and Lincoln (1981) identify four factors by which to judge qualitative research:

1. truth value
2. applicability
3. consistency
4. neutrality

Each factor is discussed in turn.

11.10.1 Truth value. The "truth value" of quantitative research is evaluated in terms of internal validity. A research design is considered internally valid when there is confidence that the findings of the study are representative of the variables found in the reality of the domain, and not of the investigative procedure itself. That is, the research process should not be the vehicle by which data is created but should be used simply as a tool for discovering that which resides within the reality of the research subject. The problem with qualitative research is that the rules for evaluating research are often the same rules for conducting the quantitative research. Guba and Lincoln (1981) suggest that credibility, rather than validity, should be used for qualitative research. A qualitative study is considered credible when the descriptions and interpretations made by the researcher are recognized by the case participants under study as faithful to the experience. To insure "truth value", the researcher has allowed the case participants to read and comment on the research report.

11.10.2 Applicability. With quantitative research, "applicability" is evaluated in terms of external validity. External validity refers to the extent to which the findings are generalizable. This presents a problem for qualitative research because it typically used with small sample sizes, emphasizing intensive and prolonged contact with the subject domain. Guba and Lincoln (1981) suggest that "fittingness" rather than external validity be used as a criterion to evaluate qualitative research. A study possesses "fittingness" when its findings "fit" into contexts outside the study situation, and when an outside audience views the findings as meaningful and applicable to their own circumstances. This researcher has attempted to match the findings in this thesis, to some extent, with other case studies investigating the implementation of ABC.

11.10.3 Consistency. "Consistency" is evaluated in terms of reliability. Reliability in quantitative research rests on the study's "replicatability". If more than one person observes the same thing, using the specified procedures outlined in the investigation, the same results should be found. The problem with qualitative research is that it emphasizes the uniqueness of the situation and is therefore less accessible to independent validation. Guba and Lincoln (1981) argue that qualitative research should be judged on the basis of "auditability". "Auditability" is present in qualitative research when other researchers can clearly follow the research progression, and the decision making as a logical means that lead to the research findings. The author has attempted to outline clearly the procedures employed and the logical path taken to derive at the research findings, as a means of addressing "auditability".

11.10.4 Neutrality. Scientific objectivity maintains that proper distance between the investigator and the subject must exist in order to limit the potential bias on the part of the researcher. "Neutrality" refers to the extent to which the research findings are free from bias. Quantitative research rests on the assumption that there is a clear distinction between the subject and the investigator. Guba and Lincoln (1981) suggest that qualitative research should be evaluated on "confirmability" rather than objectivity. "Confirmability" is the extent to which the findings reflect the reality of the case under study without regard to the position or perspective of the researcher. The researcher therefore becomes an inescapable element of the subject as a vehicle rather than a barrier to understanding.

11.11 THE DIFFERENCE BETWEEN THEORY AND DESCRIPTION

Qualitative research, such as grounded theory which is aimed at the development of existing theories and the generation of new theories, is often criticized for its resemblance to mere description of phenomena. The difference between mere description and theory is two fold. First, theory uses concepts and categories. Concepts are conceptual labels placed on discrete happenings, events, and other instances of phenomena (Glaser 1992). Categories are abstract groupings of concepts which have been interpreted as similar in relationship to a core concept. Second, concepts are shown to be related to each other by statements of relationships. No statement of relationships nor categorizing of concepts occur with description. Themes and conceptualization of data are rarely defined in a description of a phenomenon (Strauss and Corbin 1990).

11.12 CONCLUSION

It is the aim of this research to provide some insight into the implementation process of ABC at Calor Gas. The subject is as concerned with the study of the changing organization as it is with accounting techniques. The organization serves as the context in which accounting phenomena is embedded. Grounded theory procedures are employed to reach into the organization in a structured and systematic fashion, and to help explicate data, and to give the research process the necessary rigour in order to develop theories about change processes. The case study is used to provide the researcher with the opportunity to study the organization and the implementation process in-depth, over an extended period of time. The theory generated is intended to be evaluated according to qualitative research standards outlined by Guba and Lincoln (1981). The researcher has participated, to some extent, in the implementation process and considers this to be an acceptable and effective method of discovery. This is consistent with Argyris et al. (1985) view that management accounting researchers could depart from the passive observational role and actually become active participants in the change process. According to Kaplan (1993), such research is appropriate when new methods are being introduced and the research requires both comprehensive and conceptual understanding of technical innovation.

> "In this circumstance, the researcher becomes a practitioner, a part of the design and implementation process, and hence comes closer to developing not only a more complete theory of management accounting, but contributing to a more general theory of management."
>
> (Kaplan 1993)

The following chapter reports on the technical constructions developed during the implementation process.

CHAPTER TWELVE

TECHNICAL CONSTRUCTIONS

This chapter is divided into two sections. The first section is devoted to the explanation of technical implementation theories derived from the case study. It explores the usefulness of participant observation and the relevance of academic literature, to practical implementation. The second section focuses on how grounded theory procedures were employed in the case study to help organize, control, manage, and develop the technical theories outlined in section one of this chapter.

SECTION ONE:

THE DEVELOPMENT OF TECHNICAL CONSTRUCTIONS

12.1 INTRODUCTION

The results of this study, derived from using the grounded theory approach, are intended to provide an appreciation of the problems encountered in the specific case, and to suggest general guidance for other companies implementing ABC. Although there are a number of problems which have been cited in previous research (Piper and Walley 1990, Noreen 1991, Cobb et al. 1992, Friedman and Lyne 1995), this study uncovered new technical implementation problems which have been previously overlooked. The results focus on three main problems which are significant to the implementation of ABC. The first problem is concerned with how to balance the objectives of *product costing* with *cost management*[1]. The second focuses on formulating and defining ABC activities. The third problem is about the identification and analysis of cost objects. Each problem is dealt with separately. A description of the problem is presented in the specific context of this case followed by a more conceptual model which could be applied more generally in other cases.

---

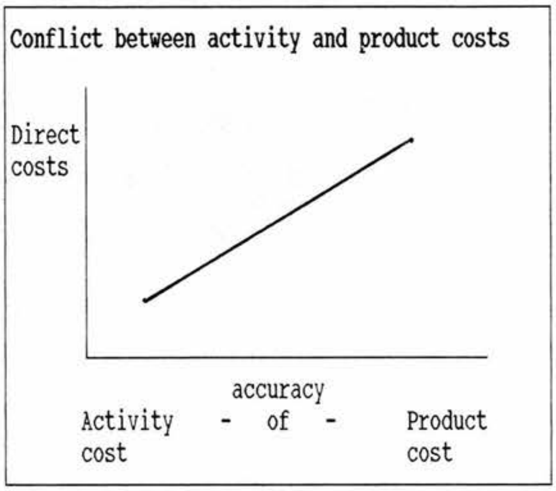
[1] Cost management is meant to include the use of cost information for making operational decisions which involve improvements in quality and process. Using activity information in this way is often referred to as Activity-Based Management (ABM) or Activity-Based Cost Management (ABCM).

12.2 BALANCING PRODUCT COSTING WITH COST MANAGEMENT

There were two formalized objectives for implementation of the new cost management system at Calor Gas. The first objective was to achieve more accurate product costs, and the second was to possess an information system to direct management's attention towards process improvement and cost reduction. At first, these two objectives appeared to be consistent with one another. Accurate product costs were perceived to be essential for focusing management's attention on rectifying unprofitable aspects of the company.

It was understood by the implementation team after consulting the ABC literature that direct costs should be traced directly to the product, bypassing the activity tracing process. In other words, the system was designed only to handle indirect costs. Direct costs are defined here as those costs that can be traced directly to the products without arbitrary allocation and without tracing through activities. Therefore, direct materials and direct labour were excluded from the ABC model.

However, as more costs were identified as *direct*, conflict arose between the two objectives stated above. The implementation team identified a number of significant expense categories that could more accurately and efficiently be traced directly to the products rather than through ABC activities. For example, salesperson salaries, advertising, machine depreciation and certain distribution costs were all named as expenses that should be excluded from the ABC model because a method existed for tracing them directly to the product which was considered more accurate than tracing them through activities. Advertising expenses were directly tracked by product, and machine depreciation was tracked by the number of machine hours operated on each product. However, because a significant amount of cost would be excluded from the calculation of activity costs, the system would be less capable of satisfying the ABM objective of directing attention for managing costs. The relationship between direct costs, and the accuracy of product and activity costs is represented in figure 12.1:



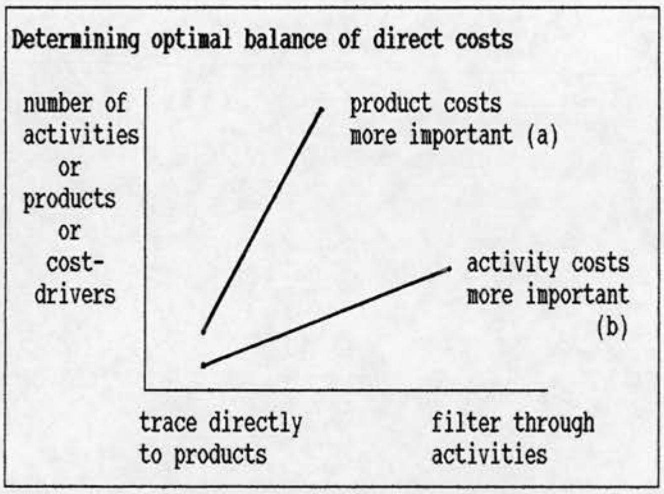
(Figure 12.1)

Direct costs, by definition, are accurately traceable to products without filtering through activities or other allocation procedures. However, the more direct costs there are in an ABC system the less accurate activity costs become. This is because activity costs are calculated from an incomplete composition of resources as direct material and labour, and other direct costs are excluded. On the other hand, deliberately tracing costs through activities, even when a more accurate method exists, undermines product cost accuracy. Therefore, a balance between these two objectives is needed.

A conceptual model for finding an optimal balance between both objectives can be constructed by recognising the variables which influence potential distortion either to activity costs or to product costs. These variables are as follows:

1. The relative importance attached to each objective
2. The monetary value of the resource category
3. The number of activities related to the resource category
4. The number of products related to an activity
5. The number of cost drivers used in the system

The question raised from the analysis is how to determine whether to trace a particular resource directly to products or filter it through activities within the ABC model. Deciding to trace a resource through activities involves a trade-off of product cost accuracy for activity cost accuracy. The relative importance given to each type of cost information determines the level of acceptable distortion. The implementation team found that the greater the quantities of activities, products, and cost drivers in the ABC system, the more sensitive activity costs were to distortion from using direct costs. For example, the team was more inclined to bypass the tracing of a direct cost through activities if the resource affected relatively few activities. A model of the variables and their impact on this decision is presented in figure 12.2:



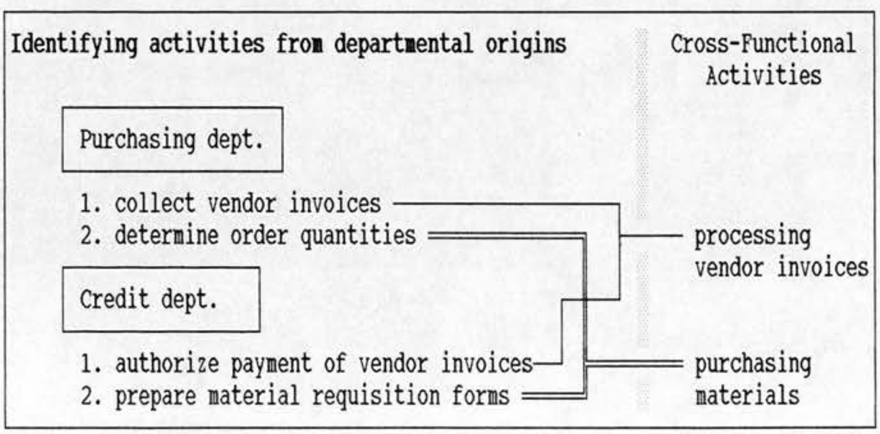
(Figure 12.2)

The slope of the line depicts the relative importance given to the objectives of product costs and activity costs. In figure 12.2, an inelastic slope (slope 'a' in figure 12.2) indicates that management is willing to accept more distortion in activity costs as a trade-off for more accurate product costs. In contrast, an elastic (slope 'b' in figure 12.2) slope indicates that small increases in the number of activities, products, and cost drivers causes management to choose to trace costs through activities rather than assigning them directly to products. As a rule of thumb, if management is equally interested in both objectives, the *direct route* should only be chosen if relatively few activities are affected by the resource. If a resource can be traced to many activities, excluding it from the ABC model will result in pervasive distortion of activity information. When management uses this information, incorrect conclusions can be drawn about the rate of resource consumption and result in sub-optimal operational and strategic decisions.

12.3 DEFINING ACTIVITIES

The problem of defining activities centres first on how cross-functional activities are identified, and second on essential criteria for naming suitable activities.

The ABC literature suggests that ABC activities cross functional boundaries within an organisation (Brimson 1991, Turney 1992). However, in practice, collecting and identifying activities may first require analysis at the departmental level. The implementation team reasoned that activities were performed by individuals normally affiliated with a specific department. When individuals were interviewed, they could only express the activity that they performed or, at best, that the department performed. In other words, the cross-functional perspective was normally not available to most employees. Cross-functional activities could only be formulated by first determining what individuals did within each department. Once departmental activities were identified, they could later be linked to similar activities in other departments forming a cross-functional activity group. This process is illustrated with an example in figure 12.3:



(Figure 12.3)

Therefore, cross-functional activities could not be collected by interview or observation because they were not actually performed by employees. Rather, cross-functional activities were formulated by the system designers by analysing departmental activities, and then linking similar activities together.

Activities were collected by assigning each member of the implementation team a functional area of the company on which to interview key personnel to collect a preliminary list of activities. Unfortunately, the initial list of activities collected from each department appeared to provide no logical avenue by which to trace activity costs to products. A sample of these activities are presented in figure 12.4:

Preliminary list of activities

1. Telephone answering
2. Customer order processing
3. Travelling
4. Going to meetings
5. Mailing
6. Photocopying
7. Stock procurement
8. Checking stock
9. Making decisions

(Figure 12.4)

These activities were compared with the definition of an activity in the ABC literature. These include the following:

> "Work performed in the operation"
>
> (CAM-I Draft Document, 1990).
>
> "The work required to produce and deliver a product"
>
> (Cooper, 1990b).
>
> "A unit of work performed within an organisation. A description of work that goes on in the organisation and consumes resources"
>
> (Turney, 1992).

The activities seemed to fit the definition of activities described in the literature. Every activity on the list was, in fact, work performed in the organisation. Particular concern was raised over the activities of *answering telephones*, *going to meetings*, *making decisions*, and *travelling* because no cost drivers could be identified to trace them to the products. For example, there was no apparent way to trace the activity of *going to meetings* to a particular product because this activity could be performed for a host of different reasons and actually be part of other activities.

After extensive debate on the subject, the team concluded that ABC-activities had to be much more specifically defined than the literature seemed to recognize. ABC activities were not simply work performed in the organisation. It was determined that ABC activities needed to be formulated and defined in a certain way so as to provide a logical method of tracing activity costs to the cost object. The Site Manager remarked:

> "How can we possibly trace *answering telephone calls* to our products? There are so many reasons for answering the phone. I think we need to understand more about why we do things rather than just how we spend our time."

To address this practical difficulty, the implementation team eventually established the following criteria for identifying and defining ABC activities.

<u>1. Mission link.</u> Activities need to possess a relationship to the mission of the firm, and there must be a stated reason for performing the activity. Activity definitions which merely categorize how people spend their time are insufficient. For example, a worker may spend considerable time walking down the hall, but this is not directly relatable to the mission of the company and should not be an ABC activity. In addition, *talking on the phone*, *going to meetings*, and *typing reports* also do not identify a link to the mission and therefore should not be named as ABC activities. The purpose of talking on the phone, going to meetings, and typing reports provide the basis for naming the activity.

2. Logical path. The activity must have an identifiable and logical path to the cost object. The activity name must provide an indication of how it is consumed by products. The implementation team identified two main paths an activity can take to the product. It could either be classified as a *support-activity* which can be traced to one or more consuming departments or as a *direct-activity* which can be traced directly to one or more products.

3. Processual. The activity must be processual or action-oriented in nature and preferably be expressed in verb form (e.g. *processing* instead of *process*). The performance of the activity must be subject to a repetition of related events. For example, the activity of *processing purchase orders* is performed by repeatedly performing a series of related events such as ordering parts, gaining credit approval, and printing the report.

4. Observable. The activity must be a visible form of work. For example, the Regional Controller (RC) insisted that one of his main activities is making decisions. The problem with this activity is that it is an abstract mental exercise which cannot be monitored. If the activity is not observable it is impossible to specify and control, and may be subject to inconsistencies and manipulation.

5. Measurable. An economic tool for measuring the activity must exist. For example, the activity *ensuring quality* is not measurable because it is not specific enough. Quality could refer to many aspects of the company and therefore no single measurement tool is available. This activity should be broken down into measurable activities such as *inspecting finished parts* and *performing quality audits*. These activities could be measured by the number of parts and the number of audits respectively.

However, applying these criteria in the case tended to leave out much of the operational detail that is essential for cost management purposes. Members of the implementation team argued that although activities such as *going to meetings* or *travelling* did not meet the newly established criteria for activities, they were still important aspects of the operation, and critical for making process improvements and reducing costs. The RC remarked:

> "We need to know how much time and cost is associated with *going to meetings*. I think it's an important aspect of how we operate here. This new way of defining activities leaves out a lot of detail which we need to manage the operation."

The problem is how to reformulate the guidelines for defining activities to include important operational detail without losing the logical connections to the cost object necessary for product costing. A two-tiered approach to activity formulation was developed by labelling activities as *primary* or *secondary*. Primary activities, which met all five criteria, could be broken down into important operational sub-activities called *secondary activities*. Secondary activities, such as *going to meetings* and *travelling*, were forms of work which lacked a mission link and a cost path, but met the three remaining criteria of processual, observable, and measurable. Secondary activities could be viewed as tasks designed to carry out the primary activity. Therefore, a secondary activity could simply adopt the mission-link and the cost-path of its primary activity, and achieve a traceable link to the cost object. This relationship between primary and secondary activities is presented in figure 12.5:

Adoption of primary criteria by secondary activities

CRITERIA	PRIMARY ACTIVITIES	SECONDARY ACTIVITIES
mission link	yes ——adopted——>	x
cost path	yes ——adopted——>	x
processual	yes	yes
observable	yes	yes
measurable	yes	yes

——operational detail——>

(Figure 12.5)

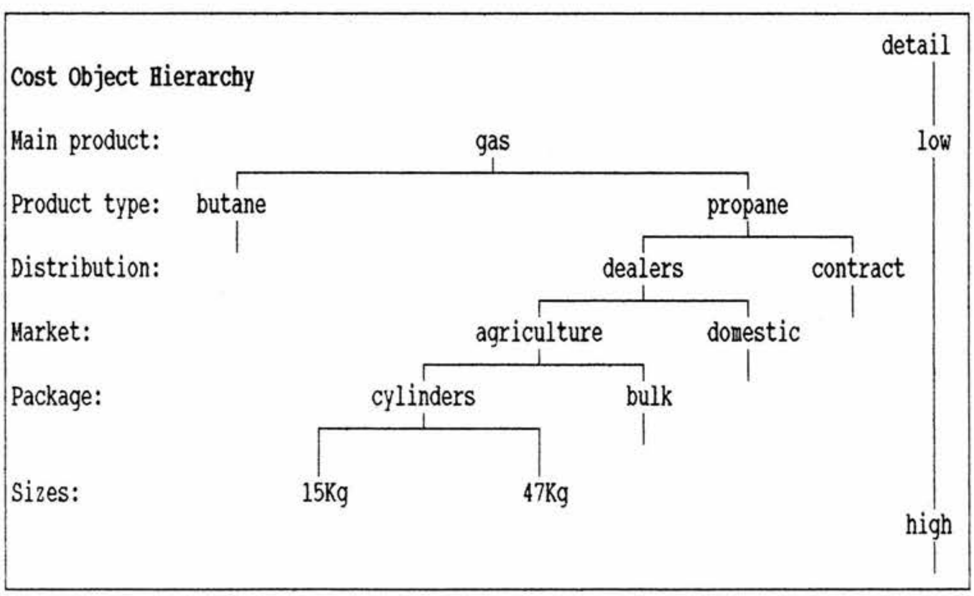
For example, the activity of managing customer queries could have several secondary activities such as writing reports and making telephone calls. These secondary activities would adopt the same mission-link and cost-path as the primary activity. Primary activities serve to ensure a logical path to the cost object for product costing, while secondary activities provide the essential detail for directing management's attention for operational decisions. By linking them together, both objectives of the ABC system could be achieved.

12.4 IDENTIFYING COST OBJECTS

A cost object could be expressed in a number of different ways, such as services provided, products produced, and customers and markets served. At first, the implementation team considered the identification of cost objects to be the easiest and most straightforward part of the implementation process, but later discovered that it was the most complex.

Although Calor Gas sells only one product, gas, the number of different package sizes, markets, and distribution channels increase the complexity of the cost object definition. Different interests among the implementation team resulted in different concepts of cost object definition. For example, the Systems/Management Accountant (SMA) did not see the point in separating a 47Kg size cylinder from a 15Kg size cylinder of butane because each required substantially the same activities and effort. Any difference in cost was attributable to the amount of gas contained in the cylinder and the size of the cylinder which could easily be determined. In contrast, the Marketing Manager insisted that the distribution channels were completely different for the 47Kg and the 15Kg cylinders, and argued that this required a different set of activities and, therefore, different costs.

As a result of this debate, the implementation team discovered that cost object categories could be viewed from varying degrees of detail, and could be managed by constructing a series of interconnecting parent-child relationships in the form of a hierarchy. For example, a product could be expressed broadly as *gas* or in great detail as *47Kg size cylinder tank filled with butane gas and sold through the "dealer" distribution channel*. Each level (from top to bottom) in the hierarchy represents a more detailed expression of the cost object. While all activities can be traced to *gas* at the top of the hierarchy, activities begin to split-off as you move down the hierarchy. A simplified version of the cost object hierarchy is presented in figure 12.6:



(Figure 12.6)

The composition of the set of cost objects could be expressed by constructing an expanding tree cascading down from the most broad expression of the cost object to the most detailed (see figure 12.6). Consequently, as you move down the hierarchy to more detailed expressions of the cost object, the costs charged to the category become smaller. For example, the activity costs charged to the category *propane gas* will be less than the category of *gas*, and the activity costs charged to the category of *propane gas sold through the dealers* will be less than that charged to simply *propane gas*.

The hierarchy can help management with implementation in four ways. First, it graphically displays the logical connections between cost object categories. Second, it facilitates matching of activity costs to the appropriate cost object category. Third, it highlights appropriate cost comparisons of different product categories. Fourth, it reveals the layers of cost associated with a product. The cost object hierarchy model constructed by Calor Gas had six layers of detail; main product definition, product type, distribution channel, market, package, and size. Although a hierarchy could provide benefits to both traditional and ABC systems, it is particularly useful for ABC systems because of the many different ways a cost object could be expressed other than by product (e.g. products, markets, customer, and distribution channels).

The cost hierarchy model can be used to match activities to cost object categories. For example, there are different activities associated with filling propane gas as compared to filling butane gas. In addition, the activities associated with filling propane gas are split further into servicing the dealer and contract distribution channels (see figure 12.6). Knowing this parent-child relationship provides management with a systematic approach to matching activities costs with cost object categories.

The hierarchy can also help management compare the profitability of different categories by highlighting logical comparisons. For example, it would be misleading to compare the cost of *propane sold through dealers* with the cost of *butane* sales. The cost of categories should be compared on the same level of the cost hierarchy. For example, it is acceptable to compare *propane sold through dealers* with *propane sold through contracts*, or *butane sold through dealers* with *propane sold through dealers*.

The hierarchy also highlights the layers of cost associated with categories as they progress down the hierarchy. For example, the cost of selling propane gas may be profitable through dealers and contracts, but may become too costly when sold through dealers for the agricultural market (see figure 12.6). By highlighting layers of cost, management can identify the point on the hierarchy which requires attention.

This hierarchy approach used by Calor Gas differs from Kaplan's (1990b) and Cooper's (1990a) hierarchy which identify four activity cost levels, namely, unit-level, batch-level, product-level, and facility-level. Each level in their hierarchy represents a cost behaviour pattern of an activity. Some activities are performed each time a unit of product is produced, and some are performed each time a batch of goods are produced. Their hierarchy also differs to the extent to which activity cost can be traced to the cost object, without resorting to a high degree of arbitrary allocation. For example, some activity costs can be traced only to the facility-level, while others can be traced down to the unit-level without arbitrary allocation.

The hierarchy used by Calor Gas is not concerned with cost object traceability, but rather with cost object definition. Kaplan and Cooper's hierarchy helps define the relationship an activity cost has to the cost objects. In contrast, the hierarchy used by Calor Gas helps to define the cost objects themselves. This relationship is represented in figure 12.7:

Two views of Cost Object Hierarchy

```
                 |     degree of detail
                 |
                 | type   channel   market   package
                 |------------------------------------>
  degree of      |  facility
traceability     |
                 |  product
                 |
                 |  batch
                 |
                 |  unit
                 V
```

(Figure 12.7)

The cost associated with a particular cost category on the hierarchy may be composed of activity costs at the unit, batch, product or facility level. Knowing the cost behaviour of activities and their relationship to the cost object, as well as defining the categories and relationship between them, is a critical aspect of the implementation process. Therefore, both hierarchical views of cost objects are potentially valuable aspects of an ABC system.

12.5 CONCLUSION

This research presented in this chapter employed a grounded theory methodology (Glaser and Strauss 1967a, Strauss and Corbin 1990, Glaser 1992) to organize data and formulate theory from a participant observation perspective (Yin 1988). Its specific focus was on the practical problems of an ABC system. The developing theory has been used to construct models for addressing specific practical problems. This process is consistent with the constructive research approach suggested by Kasanen et al. (1993), and "the new research agenda" advocated by Kaplan (1993). The application of grounded theory in an accounting context is still relatively rare, and indeed novel in the study of ABC. The case study demonstrates its potential to generate valuable findings at both a conceptual and practical level. The issues raised by the study are fundamental. They concern first the decision on what costs to include in an ABC system, second, of the core structural elements of an ABC system (i.e. an activity), and third, the nature of the cost object.

The first issue suggests that there may be conflict between the dual objectives of using information for product costing, and for cost management. No mention of this potential conflict is found in the ABC literature. Indeed, Turney (1992) and Bellis-Jones (1990) argue that ABM is merely an extension of the initial ABC systems used for product costing. In this case, using direct costs tended to increase the accuracy of product cost but tended to dilute the useability and relevance of activity costs for ABM. In addition, the number of activities, products and cost drivers all increased the complexity of the ABC system and consequently increased the potential distortion in activity costs from tracing resources directly to the cost objects. A balance between accurate product costs and accurate activity costs was obtained by accepting a certain level of distortion in each and recognising the variables which influenced that distortion.

With respect to the second issue, Cooper and Kaplan (1992a) suggest that ABC activities cross functional lines to provide a process view of the organisation. Although a process view of activities is clearly useful for making operational improvements, in practice, formulating activities in this way is problematic. In this case study, activities were identified first at the departmental level from individual employees who actually performed the work and who were associated with a specific department. Contrary to the literature (Kaplan 1990b, Brimson 1991), the research results suggest that the activities, used as the basis for an ABC system, are more than just "organisational work". The case study identifies five criteria for formulating activities. Both operational detail and accurate product costs could be gained by linking together secondary activities with primary activities in a hierarchical arrangement.

Finally, the identification of a set of cost objects is more complex than suggested in the literature (e.g. Cooper 1989b, Cooper and Kaplan 1991a). The research results indicate that cost object categories can be formulated in varying degrees of detail, are subjectively determined, and are based on the interests and agendas of the system designers. In the case study, cost objects were linked together in a hierarchy which allowed the relationships between each to be viewed systematically in order to properly match activity cost to the appropriate level on the hierarchy. This ensured that logical comparisons could be made about the costs of each category.

The ultimate purpose of grounded theory research is, however, to generate theory "grounded" in the reality which it represents. Accordingly, this case study has identified and generated information on a number of issues about the ABC implementation process. From these, a set of six hypotheses relevant to ABC system design and use are suggested for future research.

From issue 1 - Balancing product costing and cost management objectives

Hypothesis 1: There is a negative relationship between the extent to which direct costs are integrated in the ABC system, and the relevancy of the resultant activity costs. The results of this study suggest that the more direct costs are used in the ABC system the less the system is capable of providing relevant activity information for making operational decisions for process improvement.

Hypothesis 2: The greater the number of activities there are in the system the more activity costs are susceptible to distortion from integrating direct costs in the system. The number of activities influences the extent of the distortion and, consequently, the useability and reliability of the activity information.

From issue 2 - Defining activities

Hypothesis 3: ABC activities have departmental origins and are more appropriately identified by analysing the work of individuals within departments before cross-functional groups can be formulated. The results of this study suggest that cross-functional activities are actually groupings of logically-related activities identified by analysing work performed by individuals in separate functional areas.

Hypothesis 4: ABC activities must have a link to the mission of the company, possess a definite path to the cost object, be processual in nature, be observable and measurable. The results of this study suggest that to contribute to an operational costing system, activities have to be more than mere descriptions of work. Moreover, operational detail can be gained from activity analysis by segmenting activities into primary and secondary classes. Primary activities must meet all five criteria, and secondary activities are linked to primary activities by adopting the mission and path of the primary activity.

From issue 3 - Defining cost objects

Hypothesis 5: The possession of internal services by activity centres should be reflected in the cost flow path by identifying support-activities and direct-activities. The results suggest that there are two paths an activity cost can take to the cost object. It can either be traced *indirectly* by supporting other cost centres, or *directly* by supporting specific products. Both must be reflected in ABC system design to preserve accuracy.

Hypothesis 6: The use of individual products as cost objects is an oversimplification in organisations with complex and diverse product ranges. In this case, there was a parent-child relationship amongst cost object categories. The cost of each category was only comparable at the same level on the hierarchy.

The validity of the premises can be debated, and the hypotheses can be tested. Indeed, the aim of the research was to generate a faithful representation of the events as they occurred in the case so that more focused research can be conducted in the future. For example, evidence for the first hypothesis could be found by comparing a number of different companies and their objectives in using ABC. If companies oriented towards product costing predominantly used more direct costs than companies oriented towards ABM, then this would provide support of the first hypothesis.

The study goes further than formulating hypotheses. Consistent with the constructive approach (Kasanen et al. 1993), the study suggests conceptual models that could be used to address practical problems. This implies the applicability of the research results outside the specific case. However, validating the applicability of models to other companies is problematic. Qualitative research of this type emphasizes intensive and prolonged contact with the subject domain and therefore limits the external validity of the results. However, Guba and Lincoln (1981) suggest that "fittingness" rather than "external validity" should be used as the criterion to evaluate qualitative case study research. A study possesses "fittingness" when its findings "fit" into contexts outside the study situation, and when an outside audience views the findings as meaningful and applicable to their own circumstances. Thus, although further research is needed to test the hypotheses, the applicability of the models may be more appropriately judged on whether they faithfully portray implementation problems in other companies, and aid in the implementation process.

SECTION TWO:

THE APPLICATION OF GROUNDED THEORY

12.6 INTRODUCTION: ESTABLISHING CORE CATEGORIES

Core categories refer to the central phenomena around which all related concepts integrate (Charmaz 1983). Core categories help to control the focus of the study and to guide the research process. There were three core categories identified in the case which relate to the technical implementation of ABC:

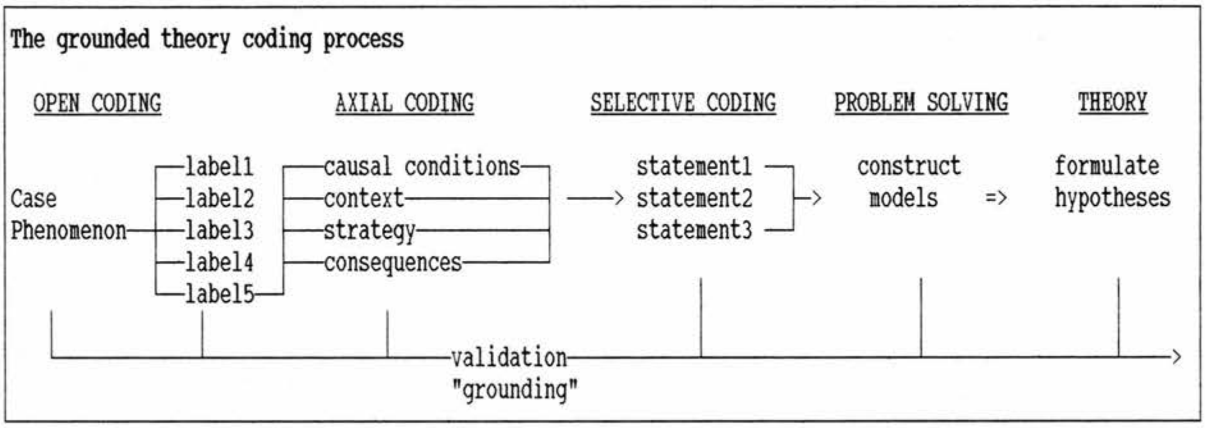
1. The process of tracing general ledger expenses to activities
2. Defining, collecting, and formulating activities
3. Establishing a set of cost objects.

These categories were developed throughout the research process. The existing ABC literature introduced preliminary technical core categories to be focused upon. Core categories were adapted to the experience of the case study, and modified in the data gathering stage of the research. For example, the assignment of resources into cost pools was revealed in the literature as a necessary step in formulating activity costs. After collecting data on this area of implementation, the core category was changed to focus more on preparing the general ledger than on establishing cost pools. Finally, the grounded theory open coding process further crystallized and refined the core categories upon which further coding analysis was applied.

The grounded theory procedures of open coding, axial coding and selective coding were applied to each of these core categories to organize and control the data and to help formulate theory. At each stage of the analysis, concepts were identified and integrated to form provisional theories which were continually tested by looking back into the data. Grounding a theory is done by examining the data, by asking questions, and by searching for consistencies and inconsistencies between stated provisional theories and the case study data. Grounded theory procedures were applied to each core category to reveal how the technical implementation theories were developed. The remainder of this section is intended to summarize the application of these procedures and to link the method of research with the research results.

The grounded theory procedures of open coding, axial coding, and selective coding are applied in this case to organize and control the enormous amount of data, to formulate models for problem-solving, and to conceptualize and develop hypotheses. At each stage of the analysis, concepts are identified and integrated to form provisional theories which are continually validated by "looking back into the data" (Strauss and Corbin 1990). This is what is meant by "grounding the theory" (Guba 1981). Grounding was accomplished by examining the data, by asking questions and by searching for solutions. Each coding procedure was applied in the case study in a progressive manner. Coding information from one stage is used as a basis for the next. However, it must be emphasized that although each coding procedure is presented in a sequential fashion, the lines between them are artificial. Many times the analysis vacillated between coding procedures. This occurred most often between open coding and axial coding.

The purpose of this section is to show how the coding procedures were applied to derive the research results. First, open coding is used to identify and analyze conceptual labels in terms of properties and dimensions. Axial coding takes the analysis further by coding the phenomenon in terms of conditions, context, strategies, and consequences. Selective coding builds on this by formulating provisional statements which could be used to formulate practical models and solve problems. Finally, formal hypotheses are developed for future testing. The entire process is summarized in figure 12.8:



(Figure 12.8)

12.7 OPEN CODING

Open coding is a process of breaking data down into manageable parts by naming or labelling specific happenings, incidents and events that occur in the case (Strauss and Corbin 1990). This was accomplished by compiling code notes both directly by assigning labels to phenomenon as they occurred, and indirectly by examining transcriptions of case notes. The labels were developed first by identifying properties associated with each label and then by defining the dimensions for each property. *Properties* are attributes or characteristics of a label and *dimensions* are possible locations of properties along a continuum. The open coding labels identified in the case, along with their properties and dimensions are presented in table 12.1:

Open coding labels with properties and dimensional ranges				
No.	label name	PROPERTIES	DIMENSIONAL RANGES	
1.	Activity costs	accuracy utility detail	very distorted not relevant specific	highly accurate very useful broad
2.	Product costs	accuracy grade levels	very distorted none	highly accurate many
3.	Objectives	consistency relevancy	low conflict not relevant	high conflict very relevant
4.	Direct costs	applicability	never	all the time
5.	Activities	criteria cross-functional origins	none not at all one	several a number of functions several

(Table 12.1)

During the course of the research, 47 open coding labels were identified but only five were eventually used in developing models and forming hypotheses. The final set of labels were composed by a process of decomposition and aggregation. Some labels were decomposed to yield new differentiated labels while others were joined together for their similarities. Many labels were simply abandoned because they were not central enough to the aim of the research.

12.8 AXIAL CODING

The axial coding technique is concerned with developing the coding labels beyond properties and dimensions into the form of conceptual statements (Strauss and Corbin 1990). While open coding was used to break-down the data, axial coding was used to put it back together in new ways. Axial coding progresses further into the analysis by explicating the **conditions** which give rise to the phenomenon, the **context** in which it occurs, the **strategies** by which it is managed, and the **consequences** that result from those strategies. Table 12.2 summarizes the results of applying the axial coding procedure to the case:

Axial coding summary					
NO.	PROPERTY	CAUSAL CONDITIONS	CONTEXT	STRATEGY	CONSEQUENCES
1.	Accuracy Utility Detail	Cost reduction Process improvement Operational use	Reorganisation Inefficiency Increase in overhead	Control and monitor Operational changes Manage activities	Effective pricing Impr. productivity New measurements
2.	Accuracy Levels	Competitive pricing Market attributes	Loss of market share Diversification	Use cost drivers Manage prod.complexity	Gain market share New prod. definitions
3.	Consistency Relevance	Company mission Control, profit	Multiple purposes Link profit to work	Balance conflict Direct cost allocation	Reduce resistance Cost distortions
4.	Applic.	Allocation methods	Volume-based	Evaluate variables	Relative accuracy
5.	Criteria Cross-func. Origins	Problems in practice Process orientation Individual/group	ABC protocol Interdependency Functional control	Set criteria Connect activities Start with departments	Workable system Gain process view Workable system

(Table 12.2)

12.9 SELECTIVE CODING

Selective coding is the process of selecting the core categories, systematically relating them to each other, validating the relationships, and filling in the gaps where further refinement and development are needed (Strauss and Corbin 1990). This was accomplished by constructing conceptual statements which connect categories to each other and then validating and refining the statements in the form of problem-solving models. A partial summary of the core category statements are presented in table 12.3:

List of core category statements
> Activity formulation depends on the objectives of the system.
> Activity definition must allow for product costing.
> Organisational work is only one aspect of ABC activities.
> Activities can be performed for support of other activities.
> People perform activities.
> Processes are composed of related activities.
> Work can be expressed in levels of detail.
> Cost objects formulation is subjective and complex.
> Cost object categories depend on the objectives of the system.
> The use of direct costs is in conflict with ABM objectives.
> Activities could be expressed in operational terms.
> The company mission gives direction to the system.
> Organisational work changes lead to process improvements.

(Table 12.3)

The statements from the selective coding process were used to form provisional hypotheses. This was accomplished by analysing the core categories and constructing models which reflected workable solutions to the implementation problems encountered. Hypotheses were used to construct models to solve implementation problems. The hypotheses were refined and validated (grounded) as the models became part of a workable solution.

12.10 APPLYING THE PROCEDURES

Most grounded theory studies have been applied to social science research in organizations researching behavioural phenomenon (Glaser and Strauss 1967a, Charmaz 1983, Miles and Huberman 1984, Corbin and Strauss 1990). Grounded theory research has been rarely used to study technical and analytical phenomena. This section illustrated how grounded theory procedure can be used to investigate technical and analytical phenomena, such as the allocation of common costs and the implications of the use of cost drivers. This section described how grounded theory procedures (Strauss and Corbin 1990) were use to help organize data and develop the specific technical ABC implementation theories described in the previous section. Organizational and behavioural phenomena, which are more commonly dealt with through a grounded theory approach, are discussed in the following chapter.

Each coding procedure is applied to the case data to develop relevant concepts which can then be used to construct theories. However, it must be emphasized that, although each coding type is presented in a formalized sequential manner, the lines between them are artificial. The coding process does not necessarily move progressively from one coding stage to the next. In many cases a single coding session will move, without conscious effort, from one form of coding to another and back again. This occurred most often between open coding and axial coding.

12.11 THEORETICAL SENSITIVITY AND THE USE OF LITERATURE

Before commencing application of coding procedures to the case data, theoretical sensitivity must be gained through examining and critically evaluating the existing literature on ABC implementation (Glaser 1978) (Chapters 2 through 10). Theoretical sensitivity refers to the researcher's ability to give meaning to the data, and his capacity to determine what is and what is not important (Schatzman and Strauss 1973). Prior research on the implementation of ABC models provided the necessary foundation on which to formulate and extract concepts from the case study data (Berliner and Brimson 1988, Brimson 1991, Cooper 1990a, Cooper and Kaplan 1991b, Bhimani and Pigott 1992a).

The grounded theory procedures that were used to enhance theoretical sensitivity in this case study consisted of asking questions in unique ways (Glaser 1978). One such procedure used to unlock meaning in seemingly uninteresting data is the "flip-flop technique" (Strauss and Corbin 1990). This technique requires using imagination and creativity to consider the data in terms of opposites. For example, much of the ABC literature supports the notion that activity costing is likely to lead to more accurate product costs. Rather than approaching this assertion directly, it was useful to consider the meaning of inaccurate product cost. This technique was used on several occasions to help think analytically rather than descriptively about the data. Two other questioning techniques were employed. They are "far-out comparisons" and "red flag identification" (Glaser and Strauss 1967a). Much can be learned by analysing substantive areas far from the focus of study.

As an example of the "far-out comparison" technique, consider the comparison of the implementation of an ABC system and the formulation of a football team. A football team needs a coach to guide the players and to develop a game plan. In order for a coach to be successful he must have the support of his teammates. He must also know the particular skills and deficiencies of each of the players in order to form an effective strategy for the match. The implementation of an ABC system also requires a sort of "coach". The leadership of the working group team leader, the support of the ABC working group members and the coordination of their skills are crucial aspects of the success of the project.

"Red flag identification" is the questioning of key phrases taken from case participants, or from existing literature, which signal that information is missing. Phrases like "it is always this way...", "we never have those..." or "there are no other reasons for...", indicate that assumptions exist which need to be questioned. This technique was applied to the definition of Calor's ABC activities. Different journals and books defined the term activity as "work performed in the organization" (Cooper 1990b, Turney 1992, Burch 1994). The underlying assumption within this definition is that activities are only this and nothing more. By "raising the reg flag" on this point, new dimensions of ABC activity formulation were able to be developed. These techniques were applied on several other occasions when it became difficult to gain anything new from the data, and thus helped to break periodic impasses on theoretical development.

A continuous comparison of prior literature and the application of unique questioning techniques to enhance theoretical sensitivity provided the basis for applying the grounded theory coding techniques in the case study.

12.12 CONCLUSION

This section of Chapter twelve outlines the specific details of how grounded theory was used to help organize and develop theory about the technical aspects of implementing an ABC system at Calor Gas. The grounded theory techniques prescribed by Glaser and Strauss (1967a) have been applied and adapted to the specific research questions and the environment. Through a system of coding and processing categories in terms of properties and dimensions, important qualitative discoveries about the case study phenomenon are revealed (Eisenhardt and Bourgeois 1989). This technique has been used to manage and control the enormous amount of data associated with case study research and qualitative information in general. In addition, grounded theory techniques helped to add rigour to the research process, which added to the quality of research results.

The grounded theory procedures were not applied without some difficulties. First, because this methodology was mainly designed for studying organizational phenomena and not analytical phenomena, certain adaptations needed to be made to the coding process (Chapter 11). Second, applying the procedures required extensive judgemental decisions on the part of the researcher, which limits the replaceability of the case study results.

In the following chapter, an organizational perspective on the change process is given. It offers insight into the change process by developing an "evolutionary" model of an organization adapting to the implementation process and new ways of thinking.

CHAPTER THIRTEEN

A GROUNDED THEORY OF THE CHANGE PROCESS AND ITS EFFECTS

Chapter thirteen is divided into two sections. The first section is devoted to the development of an organizational theory about the implementation of ABC. The second section outlines how this theory was constructed using the grounded theory technique.

SECTION ONE

THE PROCESS OF CHANGE:

Learning to Evolve

13.1 INTRODUCTION

This chapter introduces a theory of implementation, developed from grounded theory techniques, which depicts an "evolutionary process" of organizational change at Calor Gas. It is a process of change during which the organization learns to adapt to a new environment and conditions (Senge 1990). Organizational changes occur in small increments relative to the pace of learning, and the organization grows and matures in order to accommodate the introduction of new knowledge systems (Argyris and Kaplan 1994). New skills, language, technical concepts, and structures are developed. Some of the changes that occurred at Calor Gas were planned, some were unplanned, but all were part of the general evolutionary process of an organization adapting to its environment. "Evolution" in this context refers to the organization's dynamic development from its existing form to a new form in response to contingencies influencing it. However, evolution should not imply that simply evolving from one form to another will lead to beneficial results, for just as some single-celled organisms were able to evolve into complex multi-celled creatures, some forms have survived and others have not.

The motor of organizational evolution is "learning". Woolner (1991) describes organizational learning as a process of managing change by building on prior experience. Organizational learning means on-going, systematic integration of work and learning at the individual, work-group, and organizational level (Argyris and Schon 1978).

> "The reality of organizational change and evolution is its situational and organic nature. In other words, while an overall pattern can be discerned in the development of organizations, the exact nature and timing of tactics and approaches must be determined in the context of the opportunities and pressures which present themselves."
>
> (Woolner 1988 p.8)

Shields and Young (1989) emphasise the importance of learning to the introduction of a successful cost management system. They describe a behavioural model for implementing a cost management system which focuses on education, communication, and cultural adaptation. Indeed, Argyris and Kaplan (1994) suggest that learning new ideas leads to the belief that ideas are valid and useful, which encourages the implementation of new ideas.

At Calor Gas, learning seemed to be the most important element which determined the extent of its evolutionary journey. Learning occurred in three ways: first, the ABC literature provided the basis for learning about previous implementation experiences and fundamental considerations. Second, actual problems encountered required the implementation team to think critically about what was learned from the literature, and to develop new knowledge to find workable solutions (Chapter 12). This required the development of language and terms to describe concepts and events which were previously unnoticed. Finally, the implementation process itself provided an opportunity for key decision makers to gain a greater understanding of the wider organizational dynamics of the company. Managers gained an appreciation for other areas of responsibility within the company and were thus sensitized to the perspectives and requirements of other functional managers.

The change process of implementing ABC is thus not only a technical alteration, but more importantly, a learning and developmental alteration which occurs in a particular context.

Although introducing new knowledge systems, such as ABC, to an organization requires careful planning and coordination, many aspects of implementation process are unforeseen and thus could not be planned for in advance. This is because the project's progression and structure depended greatly upon the organization's response and adaptation to change.

An evolutionary change process was evident at Calor Gas. Calor evolved from its old form to a new form in order to adapt to its new environment. New ways of thinking were developed, new skills obtained, and a new language was constructed in order to communicate and think efficiently about the new ideas. This is consistent with Nahapiet's (1988) ideas on how accounting provides a language for discourse, rules for guiding action, and a way of establishing legitimacy for organizational change. The introduction of technical instructions to the organization was not sufficient to orchestrate effective change. Calor also needed time to develop the capacity to comprehend, accept, and adapt to, the change. Taking time to learn about the technical constructions of ABC, and how to manage the change process, was the key to organizational development and the implementation of ABC. An ABC system is a technical change requiring the organization to change significantly the way it manages the business environment. The change process is thus both a technical and an organizational phenomenon.

Organizational evolution in this case study is analogous to human development in some respects. For example, a child could not be expected to build a jet engine by simply being provided with a complete set of detailed technical instructions. The child must first develop motor skills, language skills, cognitive reasoning, and then be exposed to many years of engineering education. Similarly, an organization cannot be expected to construct a new cost management system without a similar maturation process taking place. At Calor Gas, it was naively assumed by the project initiators (Regional Controller (RC) and Systems/Management Accountant (SMA)) that the implementation of ABC primarily rested upon planning thoroughly and introducing the technical aspects of ABC to the organization. The project initiators did not completely comprehend how the organization, the members of the working group and, indeed, the project initiators themselves needed to develop and mature in order to accommodate new ways of thinking. Evidence of this is found in the absence of these issues in the implementation plan. Of the eleven pages of the plan document, only two lines make reference to managing organizational changes. In addition, the estimated completion time of the project was underestimated by five months because of delays in organizational adjustments.

> "There are a lot of things we should have planned for. We did not take into account the way people would react. Understanding what ABC was all about took longer than anticipated."
>
> (RC) [9]

This chapter discusses the change process of implementing a new costing system, emphasising an evolutionary process experienced at Calor Gas. It focuses on the key role learning plays in the acceptance, adaptation, and progression of the ABC project. In addition, it highlights the strategies employed by Calor to manage the change process and the unintended effects of such changes.

Section one of this chapter introduces a model of organizational development, and identifies six evolutionary phases experienced at Calor Gas. It also focuses on unintended consequences of this development. Section two illustrates how the grounded theory technique was applied in the case study to develop this evolutionary model.

The numbers in brackets ([ ]) embedded in the following text refer to case study evidence collected (see appendix for table of Sources of Evidence). Each meeting, document, memo, and interview was catalogued in a numerically sequenced table and given a reference number to identify efficiently specific sources of data which could potentially be used for a developing theory. The numerical reference numbers do not correspond to chronological events.

13.2 AN EVOLUTIONARY THEORY OF THE CHANGE PROCESS

A theory of change was developed by using the grounded theory research approach in the study of the implementation of ABC at Calor Gas. The evolutionary theory of organizational change is based on the premise that organizations, like living organisms, learn to alter their form in order to adapt to changes in the environment. This theory is consistent with the systems' approach to organizational theory, which views the organization as a living organism that responds and adapts to its environment in order to survive (Emmanuel et al. 1990).

Contingency theory is a useful way of thinking about the change process of implementing new costing systems. Organizational structures are dependent upon a combination of factors such as environment and technology, and these factors influence and change the organization (Bryman 1988). However, Emmanuel et al. (1990) argue that contingency theory is limited because it considers the organization as one control mechanism and therefore should consider other aspects of the organization, such as the accounting system and organizational design, and that response to changes in environment cannot always be explained in predictable ways.

It should be noted that the evolutionary theory of change developed here is not a universal model in the classical sense, nor is it a contingency theory model applicable to many organizations. It is rather a model of change developed from a single context which cannot be used as a general theory for explaining other organizations. However, developing a theory from a specific case does provide insight into the dynamics of organizational change which could become generalizable with future research. Indeed, the purpose of grounded theory is to develop theories grounded in data to be applied, investigated and tested in future research.

13.3 THE EVOLUTIONARY MODEL AND PHASES OF DEVELOPMENT

In order for ABC to be successfully implemented at Calor Gas, the organization needed to evolve in certain ways. The implementation process was not a unilateral injection of a new technique, rather it resembled a bilateral process whereby the organization changed and responded to change as a necessary and natural process of evolution (Nahapiet 1988). Shields and Young (1989) advance a similar notion that organizational phenomena are just as important as technical considerations and that this is often neglected in the research. They argue that the process of change, with respect to implementing a new cost management system, requires the firm to change its philosophy by focusing on behavioural issues. Emmanuel (1990 et al.) suggests that an organization changes through the transmission of information, and that information systems play a critical role in shaping organizational form. Both the organization and the new system move towards each other with each adapting and changing to accommodate the other.

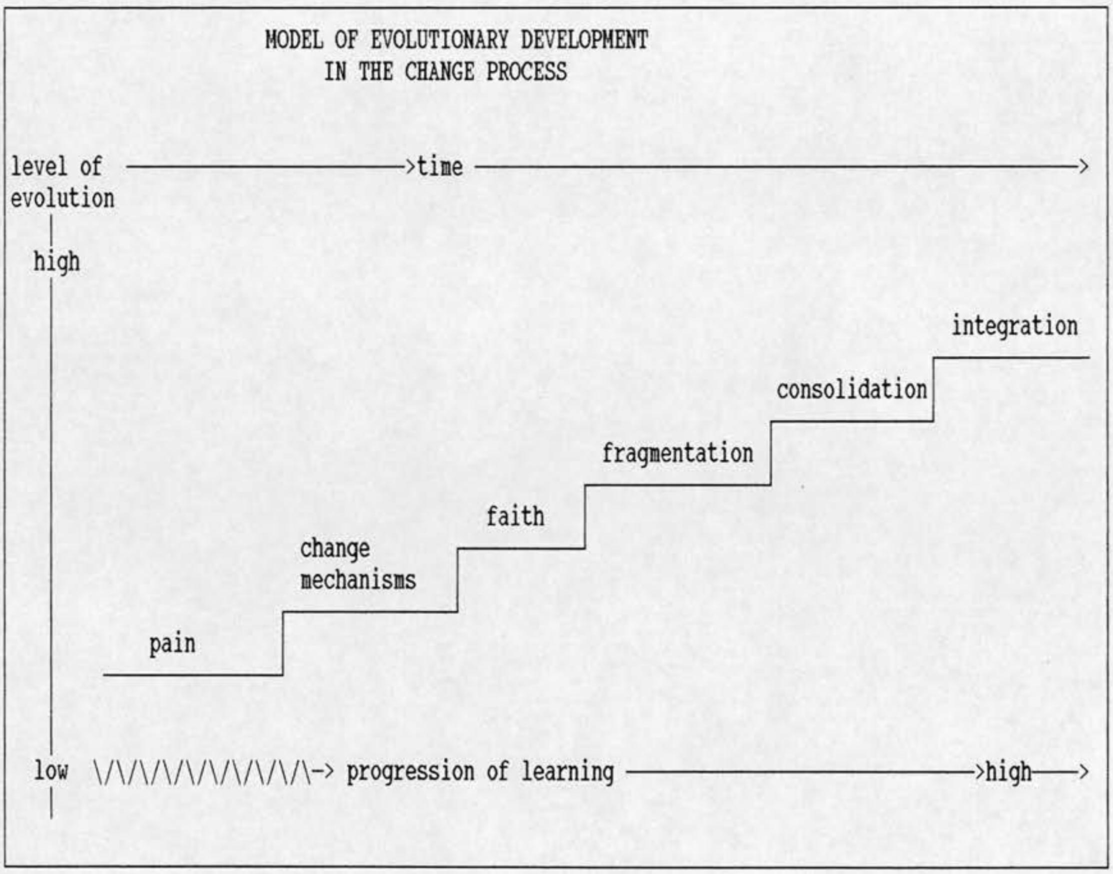
It was necessary for Calor Gas to develop new language skills and knowledge of the technical aspects of ABC as part of a maturing process. The changes occurred incrementally as new aspects of the ABC theory and technique were introduced and as the organization and its members developed, adapted, and responded to the new ideas. Changes at the individual level interact with and influence changes at the organizational level. However, the boundaries which separate each are often unclear.

Six phases of evolutionary development have been identified at Calor Gas [18, 20]. They represent an ordered and simplified view of the organizational change and reflect Calor's maturing process with respect to the introduction of ABC as the mechanism for change.

The six phases of evolution identified are as follows:

Phase 1: Reaching the pain threshold
Phase 2: Discovering mechanisms for change
Phase 3: Developing faith in the mechanism
Phase 4: Cognitive fragmentation of mechanism formations
Phase 5: Consolidation of mechanism beliefs
Phase 6: Integration

The evolutionary phases of development relate primarily to the organizational change process generally, and more specifically to the introduction of an ABC system. A model of the evolutionary process is shown in figure 13.1:



(figure 13.1)

Figure 13.1 depicts the progression of the change process as a growth phenomenon in which the organization learns to move towards its new form. Both time and learning are the factors which move the change process horizontally to each successive elevated stage of development [18]. Each phase of the model is discussed below. First each phase is discussed in general terms, followed by its relevance specific to the Calor situation.

13.3.1 Phase 1: Reaching the Pain threshold. The first stage of the development process occurs when the organization experiences some form of discomfort or pain from the existing situation. The "Pain Threshold" is the point where the cost of the current system exceeds the cost of changing to a new one. This is consistent with Innes and Mitchell (1990a), who identify generic "motivators" for change and link them to "catalysts" of change. Motivators are described as the internal and external environment of the organization, such as a competitive market place, product cost structure, or organizational structure. Catalysts are the negative consequences that result from the current system. Motivation for change is therefore a direct result of "experiencing pain" from the present situation. Discomfort or pain occurs when a company's objectives are not being achieved, and a demand for change and for information to guide change is created.

Pain can occur in a number of ways, for example, discomfort can occur when the firm is experiencing a employee morale problem. Productivity may fall and absenteeism may rise as a result. Discomfort may also result from inaccurate information which misleads management and/or renders control difficult. Pricing may be out of step with the market place, causing loss in market share. Pain can frequently be manifested in financial results. Insufficient levels of cash flow or turnover can be manifestations of "pain" which require remedial action. However, an organization does not simply change its policies and introduce a new management accounting system just because it is experiencing discomfort from the present system. This is because there are high costs associated with changing a knowledge system. It is only after the organization determines that the pain experienced from the present system exceeds the expected cost of changing it that it will introduce change. The "Change Threshold" is thus the point where the organization recognizes that the status quo is no longer a viable alternative and seeks ways of changing it.

13.3.1.1 The Calor situation. Calor had been experiencing pain broadly expressed in the form of lost market share. Over the last two decades, market share had fallen 20% as a result of new entrants into the market place, particularly from Mac Gas (British petroleum), Johnson Oil, and Flow Gas [4]. Mac Gas has the advantage of getting cheaper oil directly from its parent company, and Johnson Oil has the advantage of lower operating costs and overhead. Falling sales forced management to take a hard look at the cost of its operation. Various management techniques had been put into place to help reduce cost and improve quality of service in order to regain market share. The Grangemouth location had just finished a Total Quality Management (TQM) program (BS5750), which improved quality standards but did little to address the high cost of operations [10]. In fact, some of the case participants reported that TQM increased administrative costs because it resulted in more paperwork and records to be maintained.

Just prior to the beginning of this case study in February 1994, Calor Gas underwent a massive restructuring which resulted in the termination of almost one third of the entire workforce. The head office in Slough wanted to reduce costs quickly and demanded that each regional office cut costs by 10%. Lacking a costing system which could help identify opportunities for strategic cost reduction, Calor simply cut the number of employees to meet the cost reduction target [6].

The pain of terminating such a large number of workers was felt in three ways. First, the vacant job roles created a void in the quality of service provided to the customer. Gas orders were being delivered late and production problems began to occur [77]. Second, the remaining staff were fearful about further cutbacks. This insecurity created a climate of resentment and fear. Finally, the remaining workforce were faced with demands for greater productivity with reduced resources. Workers resented the increased workload, and morale suffered along with productivity [87].

Calor Gas reached its pain threshold when it realized that the current costing system was unable to help management address its problems. It believed that the cost of not changing was higher than the potential costs of change. The current cost system provided no information about how work was performed, what areas of the company required redesign, and how to get more productivity with less cost [13, 15]. Management had found itself in a situation that could not be sustained. This combination of market pressure, head office directives, and problems identifying cost reduction opportunities helped to push Calor beyond the pain threshold. The RC and other key members of the management team began to look for ways of changing the present system.

13.3.2 Phase 2: Discovering mechanisms for change. A change mechanism is a theory, process, or technique that possesses the potential to change significantly the organization from its present form. Its aim is to move the organization from its present discomfort position to a new less painful position. Change mechanisms normally have distinct names to designate them as new initiatives, theories, or techniques. They represent a concise body of knowledge which serves as the vehicle by which an organization can change itself. TQM programs, ABC, Process Re-engineering, Throughput Accounting (TA), Just-In-Time (JIT), and the Theory of Constraints (TOC) are the latest examples of popular change mechanisms. These techniques and theories offer an organization the potential for significantly changing its present form. They involve changes in management style, policies, organizational structure, and the way information is collected, developed, and utilized.

Popular new management theories are not the only way to promote change in an organization. Many aspects of the internal organization contribute to change as well. Innes and Mitchell (1990a) identify a number of resources termed "facilitators" which contribute to the creation of conditions which are conducive to change. These include the accounting staff resources, computing resources, and accommodation to accounting statutory requirements. Other "facilitators" may include the skills and the education level of organizational members, company culture, and management style. These facilitators are like tools which can be used in a coordinated fashion towards some specific target. Although they contribute to change, they are not the force which is behind the change, rather they are merely tools for carrying it out. In contrast to "facilitators", the term "change mechanism" is used in this context to mean a unified body of knowledge or system which represents the force designed to advance significant change.

An organization discovers and considers potential change mechanisms in a number of ways. They could be discovered internally by developing a new production design or a new way of processing and managing information, and they become change mechanisms once they are given names and are shown to possesses unique sets of ideas which have the potential to significantly alter the present organizational form. Another way of discovering change mechanisms is by looking outside the firm. Many organizations introduce change by adopting an externally popularized prepared package of ideas which has been successfully applied at other companies in the past. ABC is such an external knowledge package. Making a decision about which technique or theory is the best for the organization requires careful reflection about the nature of the required change and the unique needs of the organization. This must be matched and validated against the mechanism's claims, testimonies from other companies, and sales pitches made by external sources (Shields 1995).

13.3.2.1 The Calor situation. Based on the implementation plan and interviews with working group members, Calor Gas required change in three areas:

1) The organization needed to change the way it calculated and used costing information. [24]
2) It needed to improve productivity and reduce costs. [24]
3) It needed to change the current management information system to focus management's attention on unproductive or unprofitable areas of the company on a long-term basis [24, 37].

Calor did not possess any internal methods of making significant changes and thus turned to external sources for a change mechanism [30]. At the time Calor was looking for a way to change the organization, ABC popularity had reached its zenith. There were numerous articles and books published in both professional and academic journals testifying to the potency of ABC in making significant improvements to productivity and profit. The SMA used these publications to form an opinion about using ABC as a change mechanism at Calor. After reviewing the possible alternatives and matching the needs of the organization to the claims of popular management techniques, ABC was chosen to be the most suitable mechanism for change at Calor. It was the opinion of the SMA that ABC was the only available cost management system which could address the needs of the organization. The SMA and the RC discussed the potential of ABC and compared this with the objectives of Calor and subsequently agreed to "go ahead" with implementation. Preliminary, endorsement of the project was obtained by a brief informal discussion between the RC and the Chief Executive. It was evident that the popularity of ABC played an important role in the decision to use it as the mechanism for change. A few of the managers admitted that they knew very little about ABC and its advantages, but that the testimonies of other companies' successes with ABC, and the claims of ABC advocates, had convinced them that Calor could benefit from it as well [29].

> "According to the professional magazines (Management Accounting UK), ABC seems to be the most dramatic new management technique in the last ten years. There must be something to it."
>
> (SMA) [29]

13.3.3 Phase 3: Developing faith. Once the change mechanism is selected it must be studied, promoted, justified and introduced to the organization. Because very few people in an organization are likely to understand a complex new technique such as ABC in the beginning, the basis for supporting its implementation becomes a matter of faith rather than knowledge.

The key individuals who are responsible for introducing the change mechanism must raise support by educating others in the organization on the technical aspects of the technique and demonstrating its potential benefits. Argyris and Kaplan (1994) refer to this as the "education and sponsorship process". They describe this process as a stage of overcoming organizational resistance to change. However, it is unlikely that an organization will devote time and resources to studying a new costing system unless it has already decided to introduce it. Therefore, the project initiators must build support for the new system prior to the organization members understanding it. The education and sponsorship process begins only after the system has been accepted as the appropriate change mechanism for the organization.

When the mechanism is introduced, the project initiators as well as other members in the organization are new to the change mechanism and do not fully comprehend its structure and application. In addition, they do not yet possess the skills necessary to carry out the implementation nor the knowledge of how the technique will work within their company. Bruns and Kaplan (1991) researched the changing of an embedded cost system and discovered that management often did not understand the change mechanism at the time of giving support for its implementation. The claims and testimonies from other companies about the new technique tend to be generic and abstract in nature and do not provide sufficient insight in a specific context. Consequently, building confidence in the new technique becomes an act of faith rather than a deep definitive understanding of the true consequences of the change. Faith is the act of believing in something you do not fully understand or cannot explain. Therefore, developing faith is a necessary part of introducing a change which is not completely understood.

In the introductory stages of the change, little is known about the change mechanism or its consequences, and therefore faith rather than knowledge serves to instill the necessary confidence in the organization so that it will invest its resources and proceed with the change. Faith is developed by promoting the positive benefits to the organization before trying to convince people of the internal validity of the mechanism. This is accomplished by adding layers of support from the top of the organization on down. Top management support is obtained by outlining the beneficial results which have been obtained by other companies in the past, and by identifying a match between the company's objectives and the mechanism's features.

13.3.3.1 The Calor situation. In the early stages of the implementation, the RC and the SMA had only a primitive understanding of how ABC worked and what it could do for Calor Gas. The RC admitted that he did not fully understand ABC but believed it could help meet the objectives of the firm [9]. His belief was based on the highly publicized success stories of well known companies using ABC.

> "If companies like John Deere and General Motors think it's a good thing, then maybe it could help us."
>
> (RC) [9, 31]

In addition, the SMA performed a bit of research into ABC and concluded that the claims of ABC closely matched the objectives for changing Calor Gas.

> "ABC will give us accurate costs and at the same time give us the operational information we need to make performance improvements."
>
> (SMA) [31]

Several managers admitted they had never heard of ABC until the RC and SMA started informing the company of its intent to implement it. Each expressed a faith in its potential to improve the company without understanding how ABC works.

> "I do not know what ABC is, I just know that it is something that we will be doing which will help to improve things around here."
>
> (Stores Manager) [28]

> "I saw something about ABC in a news article once. I think it's something which may compliment our quality program (BS5750).
>
> (Quality Manager) [38]

The RC and the SMA orchestrated a campaign designed to initiate support for the project by holding informal discussions with, and giving formal presentations to, top level executives and other key personnel. They outlined the benefits of ABC and demonstrated the need for Calor to employ it as a means for improving performance. The project initiators were, in fact, "selling" the ABC project to the rest of the company. Gaining the confidence of top management and convincing the rest of the organization that ABC was right for Calor was believed to be essential for the success of the project. Argyris and Kaplan (1994) refer to this as "Creating Internal Commitment". However, since the project initiator did not yet understood how ABC worked nor what it could really specifically do for Calor, faith in ABC claims provided the basis for building confidence [81].

13.3.4 Phase 4: Cognitive fragmentation. Cognitive fragmentation refers to the different ways organizational members learn, adapt, and support the change process, and to the incremental progression of the ABC project itself. If cognition is the process of knowing then cognitive fragmentation is the process of knowing in fragments. The process of knowing about a change mechanism is fragmented because of the different perspectives, skills, agendas, and cognitive abilities of the organizational members. During this phase of development, the organization as a whole does not possess a complete and unified understanding of the change process. Emmanuel et al. (1990) identify three individual cognitive limitations which affect the use of information:

1. the amount and complexity of information
2. systematic filtering
3. psychological failures which hinder the brain's openness to information

These factors refer to the individual's capacity for learning. These individual limitations impact the progression of the change process and fracture the coordinated effort of implementing a new costing system. Thus cognitive fragmentation is the result of individual learning behaviour having an impact on the organizational change process.

Cognitive fragmentation with respect to the implementation of new costing systems occurs in three ways: first, the technical aspects of the change mechanism are made known in increments over time, the theory or technique is learned in "bits and pieces" as new knowledge mixes in with existing knowledge; second, organizational members learn about the change mechanism at different rates, some beginning to use the new language to communicate ideas and describe events, while others still struggle to define basic terms; third, the extent to which the organizational participants accept and support the change mechanism [81]. The reasons for these different levels of acceptance may depend upon a number of factors. The difference may depend on the organizational member's position in the organization, technical knowledge of the change mechanism, or the perception of how the change will affect each member individually.

Cognitive fragmentation is a natural part of the change process, but it also acts as a restraining force on the evolutionary process by slowing down and moderating the pace and content of change. Organizational change is carried out by individuals in the organization who have their own capabilities, knowledge, values, skills, agendas, ambitions, and fears (Shields and Young 1989). Different levels of learning disrupt the communication of ideas and slow down the implementation of new management techniques. The concerns or fears raised may be due to either job insecurity or loss of power, and may restrict the magnitude of the change and retard the potential benefits of the change mechanism. On the other hand, legitimate concerns about the validity of the change mechanism may act to improve or refine its application.

13.3.4.1 The Calor situation. The Calor implementation team (Calor referred to this as the "working group") was composed of organizational members from a broad range of functional areas within the company. The group consisted of personnel from accounting, marketing, sales, information systems, purchasing, production, and quality control [14]. Cognitive fragmentation was amplified by the multi-disciplined composition of the this team. Members came to the ABC implementation process with different skills and backgrounds which increased the learning gap between members. For example, working group members who possessed some knowledge about accounting and finance tended to learn the cost allocation aspects of ABC faster than those without a financial background. However, those members who came from production and distribution areas were able to grasp the formulation and collection of activities better than those affiliated with administration [77].

> "I understand the activity part of this ABC thing but I still don't get what a cost driver is."
>
> (Site-production Manager) [102, 78]

> "How do you expect us to collect activities when we don't know how ABC is going to be used"
>
> (Marketing Manager) [102]

> "How are we going to trace the cost of things like manager's salaries and electricity expenses to product?"
>
> (Accounting Supervisor) [78]

This researcher also played a role in fragmenting the learning process by attempting to inform the group, using generic external case studies as examples of ABC implementation.

A gap between the ABC literature and practical implementation thus increased cognitive fragmentation within the group.

> "The way other companies implemented ABC does not seem to fit anything we do here."
>
> (Salesperson) [102]

There was also a learning gap between the project initiators and the rest of the working group. The project initiators lead the learning process by first learning a bit about ABC and then introducing it to the other working group members. Learning was done in small increments to push the project forward from one phase to next. Cognitive fragmentation resulted when the project initiators advanced their understanding of ABC knowledge independently of the working group. The project initiators, in effect, remained several steps ahead of the rest of the group in terms of understanding ABC concepts [68].

This learning gap between project initiators and the working group was most evident in the early stages of the planning process. In order to construct a preliminary implementation plan for the working group to discuss, the project initiators needed to advance their learning far beyond the rest of the group. Several books and journal articles helped to structure the progression path of the project (Cooper 1990a, Brimson 1991, Turney 1992). A rough draft of the preliminary plan was prepared by the project initiators and then presented to the group to consider [65]. Once discussion was under-way, it became evident that the rest of the group lacked the knowledge of ABC necessary to construct and evaluate an implementation plan. The input from the working group was limited, and the project initiators had to spend much of their time attempting to explain basic ABC terminology. This learning disparity was recognised and, as a result, the working group was encouraged to research the same publications used by the project initiators to prepare the plan. When the working group gained the necessary incremental knowledge of the implementation plan, they proceeded to participate in its refinement. However, the gap between project initiators and the rest of the working group persisted as each new stage of implementation was encountered. This learning gap eventually dissipated towards the later phases of the change process [13, 17, 19].

Other forms of cognitive fragmentation occurred when some members of the working group began to use the ABC nomenclature to communicate their ideas while other members still struggled with ABC concepts and terminology. This diversity of knowledge slowed the project down and created a degree of resentment among those members who had difficulty contributing to the project. Those members who could successfully articulate their ideas using ABC language influenced the project's direction and gained a degree of power over other members [84]. Those members who understood how ABC worked, and could argue their point using the ABC language, possessed a distinct advantage over other members of the group by getting their views incorporated into the system design. In addition, those working group members who had a higher degree of participation tended to have more of a personal investment in the project and were consequently more supportive of the change process in general. In contrast, those members who contributed less to the development of the project grew to fear the change process and even became inclined to create obstructions to implementation. For example, the Purchasing Manager continuously interrupted the progression of meetings because terms were used that he did not understand. His input, over the course of the project, became less contributive and more obstructive. Before data collection began, it was agreed by the working group that managers would be given responsibility to collect information from areas that were unfamiliar to them. On one occasion, over the objections of the other members, the purchasing manager insisted that he be given a data collection area because of his apparent familiarity with the area. This was interpreted as a disparate attempt to maintain some level of power and control over the project [107]. The Purchasing Manager could maintain a sense of control by first getting his way, and second by collecting data in an area he understands. On another occasion, the Quality Control Manager, who also had difficulty with ABC concepts, questioned why he himself was even part of the working group.

> "Why should we 'non-accountants' be worrying about costs anyway? This is not our job. It's the job of the finance (accounting) department."
> (Quality Control Manager) [29]

There seemed to be a strong correlation between the level of ABC knowledge and the level of support for the ABC system. The primary factors which influenced the pace of learning depended mostly upon individual member attributes such as intellectual capacity, willingness to study ABC publications, and an open minded disposition. Secondary factors, such as functional responsibilities and level of education, also influenced the pace and extent of understanding. Knowledge of how ABC systems worked moved some working group members towards support for ABC and confidence in the change, while the relative lack of knowledge and fear of change tended to move other members towards obstruction of ABC implementation.

Cognitive fragmentation was managed in four ways at Calor Gas. First, there was a deliberate attempt to encourage members to independently educate themselves on ABC concepts. A mini library was set up, which consisted of several books and articles from journals, to make this easier. Second, special help was given to those members who had difficulty with ABC concepts. For example, a tutor session was arranged for the Purchasing Manager on several occasions. Third, through discussion with members from many different departments, members became more familiar with other functional roles in the change process, which helped to reduce fragmentation. Finally, the project initiators attempted to reduce the fear and resistance to change by moderating the power and influence of more knowledgeable members. For example, the Site-Production Manager was able to articulate his views very successfully using ABC language. He attempted to influence the ABC system by constructing an argument which linked quality control activities to market demand requirements. This was over the objections of the Quality Control Manager. Unfortunately, the Quality Control Manager could not fully appreciate the implications of the argument nor articulate a convincing objection. In an attempt to moderate this disparity and reduce conflict between members, the SMA made special efforts to consider the perspective of the Quality Control Manager and to help to formulate a proper response [24, 26].

There was also an attempt to develop an "in house" language by using generic terms from the literature and adapting them specifically to Calor. For example, the term "data collection area" was developed to identify specific information domains. Other terms such as "re-allocation", "primary activities", and "support activities" helped to reduce fragmentation by making the ABC concepts more familiar within the Calor context (these terms were used and discussed in Chapter 12).

13.3.5 Phase 5: Consolidation of mechanism beliefs. Consolidation of mechanism beliefs refers to the narrowing of disparity among organizational members with respect to understanding, adapting, and supporting the change mechanism. Although faith is replaced by knowledge of the change mechanism, it remains unclear whether the mechanism will change the organization as expected or whether the expected change will achieve the company's objectives.

Over time the members begin to comprehend the technical nature of the change, which reduces the level of fear and resentment directed at the change (Dent 1986). When cognitive fragmentation is reduced it accelerates the progression of the implementation process and consolidation of mechanism beliefs. A new fluency of the change mechanism language is evident at this phase of evolution. However, although the mechanism concepts are more universally understood, the consequences of the change are still less then clear.

At this phase no member of the working group can be sure about how the new system will effect Calor specifically. Generic expressions of ABC benefits generated in other companies are difficult to extrapolate, nor can they be relied upon to work in the same way in the Calor context. Consequently, belief in the change mechanism continues to play a role in maintaining support for the project. The dissipation of cognitive fragmentation reduces the reliance on faith as a basis for change, however, the organization does not know how the system will perform once in place.

Members spend so much of their time and effort struggling to learn the technical aspects of the new technique by collecting and analysing information and solving problems that they become intimate with the project's development and personally invested in its success. Moreover, members' professional reputations become closely associated with the project's influence in the organization. This linkage between individual members and the change mechanism further supports and consolidates the change process (Dent 1986). In addition, the use of a common technical language, and the struggle of the implementation process itself, increases cooperation and reduces the level of fear and resentment among members (Nahapiet 1988). The consolidation of personal investment in the implementation increases support and the belief that the mechanism will fulfil the stated objectives of the change. However, until the change is complete and the new system is utilized in the decision making process, it remains uncertain how well the change mechanism will succeed. Therefore, the members tend to express their estimations of the success of the project using the word "hope". Strong confirmations tend to be rare and based on belief in the change mechanism itself rather than certain knowledge of its consequences.

13.3.5.1 The Calor situation. The consolidation phase was realized at Calor when everyone in the working group generally understood and used the new ABC language fluently. This was evidenced by observing several meetings where sophisticated debates arose over how to address technical problems [24, 26, 29]. For example, the working group debated the use of activity costs as a means of tracing certain resources to cost object [24]. Every member of the working group participated in the debate to some degree by offering different views and using terms such as "activity driver", "cost object", and "cost pool" as a normal part of their vocabulary. In addition, old ways of thinking had given way to new. For example, working members no longer considered cost variability only in terms of production volume [39]. As the project grew nearer to completion, members expressed satisfaction with the development of the project as well as concern over how successful it would be once it is put into practice. Although the working group now had a nearly complete understanding of ABC, it remained to be seen how well the system would meet the objectives and expectations of the company.

> "After all the work we put into this system, I hope that it's worth it"
> (Marketing Manager) [87]

> "I don't know whether this new system will actually make a difference. I can't see us dropping a product line because ABC tells us it's not profitable."
> (Quality Control Manager) [77]

It also remained uncertain how well the new ABC system would help Calor to achieve its objectives of better cost information and increased productivity. The team remained hopeful in its belief that ABC would live up to its well publicized reputation. It is significant to note that, even as the project grew near to completion, an element of hope and apprehension existed in the group with regard to the use of ABC. This feeling may have something to do with Calor's experience with other management initiatives in the past, which promised similar benefits as ABC, which were not realized.

> "Management gets us all motivated to work on a new project which requires a lot of work and promises to make big improvements, but after the project is complete no one seems to remember what all the fuss was about or why we even did what we did."
> (anonymous source) [87]

13.3.6 Phase 6: Integration. Once the change mechanism has achieved the initial change, integration between the mechanism and the organization occurs. Integration refers to the evolutionary phase in which the change mechanism has completed its change impact on the organization, and has lost its separate identity. The organization takes what it can from the theory or technique and then divorces itself from the mechanism as a necessary part of the change process. The organization now possesses new attributes of the intended change in the form of rules, policies, management style, and company culture. Integration occurs when the intended change has been accomplished, and the organization no longer places special focus on the change mechanism nor refers to it by name. Change mechanisms which possess acronyms such as ABC and TQM are only really successful and complete once the acronym is no longer referred to in the process of change (Friedman and Lyne 1995). Only after the organization stops calling the change mechanism by name does the organization cease to introduce the mechanism. Although the changes introduced by the mechanism will continue to be seen within the organization, the process of change with respect to the mechanism is complete. At this phase, the change mechanism loses its project status and becomes an integral part of the company, leaving behind its separate identity.

13.3.6.1 The Calor situation. Calor has not yet reached the integration phase of evolutionary development. The ABC implementation is still in progress and is likely to remain in progress until more refined models are constructed. Evidence of this evolutionary phase is based on case study participant's estimations of the future and on analysis of other cases found in the ABC literature. Although grounded theory is applied primarily from data collected from the case, prior experiences with ABC implementation also provide data which has be incorporated into a developing theory.

The Calor working group attempted to plan for this final phase of evolution by recognizing the need to standardize the data collection process so that it becomes fully integrated in the company and loses its focus as a change mechanism. The RC insisted that, in order for ABC to work, Calor must stop calling it ABC and refer to it as simply "our information system" [82]. He also admitted that the intense focus of the project and the devotion of resources could not be sustained over a long period of time.

> "We can't be doing ABC forever. Sometime soon it must be just the way we do things around here."
>
> (RC) [82]

> "Once the first model is complete, we have to stop looking at it as a project and start looking at it as a long-term management information system."
>
> (SMA) [82]

There is evidence from other ABC case studies that many firms do not evolve past the consolidation phase (Cooper and Kaplan 1992a, Shields 1995). Consequently, the long-term benefits of ABC are lost. Many firms refer to ABC as a "project" or "study" which implies a temporary nature. The implementation of ABC requires the extensive use of time and resources which cannot be maintained indefinitely. Integration of ABC and the existing information structure must take place in order for the new thinking to be internalized and, indeed, the benefits to be realized over the long-term.

A summary of the evolutionary phases of development identified at Calor Gas is presented in figure 13.2:

PHASE	DESCRIPTION
Phase 1	Organization experiences pain as a result of the current situation. Pain Threshold is reached when pain becomes greater than the expected cost of change.
Phase 2	Organization searches out possible mechanisms for change: New costing systems, management theories or new processes. Change mechanisms are selected from internal or external forces.
Phase 3	Project initiators sell the change mechanism to the organization. The organization develops faith that the change mechanism will achieve the firms objectives.
Phase 4	Organizational members begin to learn about the change mechanism. Learning and acceptance of the change is fragmented by the different views, perspectives and agendas of the organizational members.
Phase 5	Learning and acceptance fragmentation begins to dissipate. Change mechanism language is used fluently. Personal investment in the change increases. Faith is replaced by greater understanding and belief in the change mechanism achieving the firms objectives.
Phase 6	New thinking becomes internalized. Change process is complete with respect to the change mechanism. Less focus on the change mechanism and integrates with the organization.

(figure 13.2)

The divisions between the different phases of evolutionary development identified above are artificial. In the case study there was no "clear cut" orderly progression from one phase to the next. Often it was unclear what stage of development was actually being observed. Many times the change process seemed to vacillate between one phase to another and back again. This was particularly evident between phases three and four. For example, the dissipation of cognitive fragmentation was a gradual process which crossed over the boundaries between phases. Fragmentation persisted even through the consolidation phase and beyond. The evidence in the case suggests that fragmentation dissipates gradually, which in turn gradually promotes consolidation. Although the boundaries of the phases are not clear, what is clear is the organization's maturing response to the implementation of

ABC. The evolutionary phases of development experienced by Calor emphasise a maturing process which cannot come about simply by injecting new technical instructions into the organization. Organizational change comes about over time through a process of incremental learning and adaptation to the new environment. It remains unclear to what extent this maturation process can be orchestrated. However, recognizing that an organization needs to evolve in this way may sensitize management to the needs of the organization undergoing change, and may help promote the introduction of new management systems.

13.4 CONSEQUENCES OF THE CHANGE

The evolutionary changes that an organization undergoes in order to adapt to a new environment result in various unintended consequences. Bhimani and Pigott (1992a) identified a number of unintended consequences of implementing an ABC system. Their research suggests that implementing new costing systems may change the organization in ways that could not have been anticipated at the planning stage and were therefore not part of the planned change. Although the intent of evolution is to advance from one form to another, change is not without risk and complication.

As a result of evolutionary changes, Calor experienced four identifiable unintended side-effects. These effects occurred, not at the completion of the change, but rather during the implementation process itself [71]. They include the role of accounting personnel and accounting information, power and control hierarchies, performance and reward configurations, and information accessibility (Friedman and Lyne 1995). In addition, these consequences are particularly relevant to the evolutionary phases just discussed. These are all discussed below.

13.5 LINKING EVOLUTIONARY PHASES WITH THE UNINTENDED CONSEQUENCES OF CHANGE

Specific unintended consequences resulted from each phase of evolutionary development. Each phase contributed either directly or indirectly to four identifiable consequences at Calor. These are as follows:

1. A change in the role of accounting personnel and accounting information.
2. A change in power and control hierarchies.
3. A change in performance and reward configurations.
4. A change information accessibility.

The pain experienced from the existing system fostered discontent among many areas of the company. Organizational members wanted to change the system and looked to accounting personnel to lead in this regard. Although accounting information was regarded by many managers as "irrelevant", they still considered the accounting personnel as highly competent and knowledgeable. The search for a change mechanism naturally fell within the realm of accounting's responsibility. This underlying view of accounting personnel helped to foster faith in the selection of ABC as the change mechanism. Cognitive fragmentation created a volatile environment in which power structures could be influenced. In addition, fragmentation permitted performance and reward schemes to be examined and redefined. In the consolidation phase, information was the prime medium for the efficient exchange of ideas and cooperation. This encouraged the organization to re-examine its traditional information distribution policy and to increase access to functional managers. Each consequence of the implementation process is discussed below.

13.5.1 Role of accounting personnel and accounting information. The implementation of ABC at Calor Gas changed the way accounting personnel performed their jobs, and altered how non-accounting members perceived the role of accounting personnel and accounting information (Bhimani and Pigott 1992a). Prior to the implementation of ABC at

Calor Gas, accounting personnel produced a standard set of financial statements and budget variance reports. The main mission of the accounting department was to report and summarize historical transactions and to police company overhead budgets. Decision support was also seen as the mission of accounting but they were unable to fulfil that role.

> "We should not only be reporting on historical events. We should also supply management with information to help them make decisions in the future. However, we currently lack an information system which would allow us to do this. This is one of the reasons for implementing ABC."
>
> (SMA) [102]

Other members of the organization confirmed this established role of accounting. Accounting personnel were perceived to be those responsible for cost control and budget monitoring. This was evidenced by the detailed standard monthly budget and variance reports distributed to functional managers. Accounting personnel performed a budget enforcement role by investigating excessive unfavourable variances. When excessive variances occurred in a particular functional department, it was accounting personnel who summoned the functional manager for an explanation.

> "When you go over (exceed the budget) you have to justify it to the accounting department."
>
> (Site-production Manager) [76]

Several of Calor's functional managers admitted that they did not believe they should be held accountable for many of the costs in their budget because they did not have control over them. They were referring to the overhead cost items which were allocated to each department. They did not agree with the way costs were allocated nor did they understand the logic behind it.

> "I cannot understand how these costs are determined. How do they (accounting personnel) know how much overhead is used if they never take the time to visit this department to find out?"
>
> (Site-Production Manager) [3]

The perception of the quality and utility of accounting information varied among functional managers. Some functional managers simply accepted that the accountants must know what they are doing, while others simply privately refused to legitimize the accounting reports. The Marketing Manager viewed accounting information as only slightly relevant to the marketing department. Allocated overhead costs were based on traditional allocation schemes which were perceived to provide little utility to the marketing of products. In addition, budget figures were based mainly on historical precedent and could be violated given the correct conditions [30]. The Production Manager appeared more reliant on accounting information, but still held similar opinions about the usefulness of overhead allocation. Direct cost reporting with regard to materials and labour was of primary interest to the production department [31]. Allocated overhead costs were not normally focused upon. Non-accounting managers in general perceived the accounting department as a detached and sometimes irrelevant part of management [30].

The ABC implementation process increased the perceived relevance of cost information and tended to legitimize the role of accountants as an integral part of management. There are three factors which contributed to this. First, the multi-functional composition of the working group improved the communication between accountants and other members of the organization. This led to a greater understanding of all functional departments. Second, the non-accounting managers were included in the construction of the system which improved their understanding of the problem of cost allocation and reduced their fear and suspicion of the change. It also helped to build confidence and support for the ABC system. The third factor is the recognition by working group members of the validity of ABC as an effective cost management tool. It is likely that all of these factors played a role in changing the perception of accountants and accounting information [117, 118].

13.5.2 Power and control hierarchies. The implementation process altered the power structure within the working group. Organizational power was manifested in two ways; firstly, by an individual member's ability to influence the direction and content of the ABC system; and secondly, by utilizing "ABC logic" to legitimize proposed courses of action beyond the project itself. This is consistent with Bhimani and Pigott's (1992a) study in which ABC provided factory managers with a tool for justifying desired changes using ABC terms.

Members of the working group who were able to understand and grasp the ABC concepts had more influence over the content and direction of the ABC project (Nahapiet 1988). This was partly due to members' ability to articulate their ideas more effectively by using ABC language, and partly due to members' ability to foresee the implications of the system. Members who had difficulty with certain ABC concepts limited their contributions when debating important issues, and thus were less likely to influence the direction of the system. The knowledge of ABC concepts and the use of ABC terms are key factors in the level of influence over the project.

An illuminating example of the extent to which a members' command of ABC language and understanding of ABC concepts altered the power structure of the group occurred when a junior support member joined the group. An accounting student from Stirling University had joined the group to help with the implementation of the project. Her role was to work full-time on the project, assisting senior working group members with any area which deserved attention. Because many of the members had tight work schedules, much of the detailed work of the ABC project had been pushed on to the university student. As a result, the student's understanding of ABC surpassed that of many senior members of the group. Her command of ABC concepts and language increased significantly as a result of the amount of time and energy spent on collecting data and preparing reports [114]. In the beginning, her participation during the working group meetings was limited as she sat quietly on a chair which was detached from the main conference table. Her participation in the meetings dramatically increased as other members of the team began to rely on her familiarity with the information. Even the seating arrangement was adjusted to permit the student to join the main conference table. Over time the accounting student's influence over the structure and content of the ABC system increased as a direct result of her command of ABC language and concepts [102, 114].

Another way in which power structures were altered occurred outside of the project domain. As the logic of ABC became known and accepted as a valid management theory, functional managers began to formulate arguments using ABC concepts to justify proposed courses of action. For example, the Marketing Director attempted to justify a strategy which would place a greater reliance on the distributor network by saying that it would reduce the cost driver (sales visits) for the sales department [114]. In addition, the Quality Manager chose to change the way inspections are conducted based on the recognition that the number of inspections had been identified as the cost driver. Those functional managers who could effectively formulate arguments in ABC terms possessed greater flexibility in running their departments. The accepted validity of ABC logic became the basis upon which organizational members formulated arguments to influence the organization. There was greater credibility placed on a manager's ideas or plans when they were articulated and expressed through ABC theory.

13.5.3 Performance and reward configurations. Influencing the design and structure of the ABC system will ultimately influence the development of performance measures and reward configurations (Friedman and Lyne 1995). Members who possess control over system design may consequently exert influence over their own reward distribution and that of others. There is no evidence in the case study to suggest that any member of the working group intentionally manipulated the design of the system for self gain. However, there is some evidence that members recognized the potential for the ABC system to disrupt current reward systems and considered this potential impact in the system design [102].

Cost drivers serve a dual role in an ABC environment. Cost drivers are used to calculate product costs and to evaluate performance (Innes and Mitchell 1990c). Since cost drivers serve to measure the consumption of resources, they are also useful for measuring the performance of functional departments and assign responsibility for cost control efforts (Cooper and Kaplan 1992b). In addition, since management's ultimate aim for the ABC system is to influence the behaviour of organizational members, invariably cost drivers play an important role in the development of reward systems. Using cost drivers to measure the level of resource consumption provides an opportunity to evaluate performance in operational terms. For example, the distribution of gas could be evaluated by the number of missed delivery dates, and the engineering department could be evaluated in terms of the number of parts designed into the product [90]. The cost driver thus serves as a versatile measuring tool for assessing the performance and reward configurations as well as for determining product costs.

An example of functional managers finding the connection of cost drivers to rewards systems occurred as the working group considered which cost drivers were appropriate for driving marketing activity costs to the products. Before the introduction of ABC, sales commissions were paid based upon a complex formula using gross profit as the primary variable [103]. Gross profit was determined by subtracting total direct material and labour costs from sales. The Calor sales commission plan was designed to give proportional reward to the level of profit contributed through sales. It was widely believed that the higher the gross profit of a product, the higher the profit contribution. After considering the potential effects of product diversity and complexity, and the utilization of multiple cost drivers which ABC introduced, doubt was raised over whether the sales commission plan was, indeed, rewarding profit contribution. The group tested the commission plan by comparing the 47kg butane cylinder with the 15kg cylinder. The 47kg cylinder had a higher gross profit percentage then the 15kg cylinder. After investigation, the group discovered that the 47kg cylinder required a higher average of sales calls than the 15kg product and also consumed more of the billing department's time and energy with invoicing and collection [107]. The group determined that the traditional method of rewarding the sales force needed to be revamped and based on the new ABC ideology. The Marketing Director appeared to resist the challenge to the existing plan.

> "If the sales force is rewarded using cost drivers which incorporate overhead costs from all over the company this would undermine the incentive system.
> (Marketing Director) [121]

The Marketing Director's argument was based on the belief that Calor should not be punishing the sales force for inefficiencies from other departments. Doing this would create a disincentive for sales personnel because much of the control over their reward would have been taken away.

> "If the production line or administrative staff are inefficient it should not affect the sales force rewards."
> (Marketing Director) [121]

The way ABC information changed the way product costs are determined resulted in a loss of power by the marketing department to control its own reward system. The argument the director raised may be a valid one but it also underscores his agenda in attempting to influence the design of the ABC system in order to retain the existing reward systems and prevent any relinquishing of power and control.

13.5.4 Information accessibility. The construction of an ABC system requires the wide distribution of financial and non-financial information. Prior to the implementation of ABC, Calor's top management restricted certain sensitive financial data to key personnel only. Even information which may have been beneficial to a functional manager was withheld for security reasons. For example, the Information Technology Manager did not have access to balance sheet information, and the Quality Control Manager was not permitted to view cost budgets from other departments. ABC forced top management and the Accounting Department to re-evaluate its control over financial information. In order to build an effective ABC system, functional managers from many areas of the company needed access to information which was previously restricted. This led to a degree of insecurity among top executives.

> "I don't think we should let every manager in the company be able to rummage through our books."
>
> (Regional Director) [121]

Gradually, sensitive financial information was declassified and made available to the working group. Working group members felt positive about the new trust and responsibility afforded to them. It also gave them a clearer understanding about how the company works. After reviewing financial reports and learning about other departmental cost structures, a few members remarked that they could not understand the reason the information was restricted in the first place. Calor was forced to break with tradition in order to advance the change process.

> "I didn't realize how much money this company spent on a monthly basis, or how much my department spent in relation to others. I think I should have known this stuff all along."
>
> (Sales Manager) [19]

Non-financial information was not restricted, but it was not widely shared among departments. For example, the Filling Department developed information about the efficiency of cylinder testing. It kept track of the rate of cylinders passing through the filling machines before testing. This information was useful to evaluate performance trends and to focus on improvement efforts. Other departments developed similar types of information without sharing it with other departments. ABC required managers to think in terms of processes which cross functional lines. Consequently, working group members developed a need to understand the qualitative information from other areas of the company. Sharing qualitative information was necessary in order to build the ABC system. It also gave managers a greater understanding of the company as a whole, and an appreciation of the problems and perspectives of other functional managers.

13.6 CONCLUSION

From the case study results it is clear that an organization cannot simply be injected with an accounting technology such as ABC. Rather, the introduction of new knowledge systems requires a bilateral approach, focusing on both the technical and organizational dimensions. The organization's current structure, methods, policies, management style, skills, and information system must be considered in a two way process of technical modification and organizational adaptation. The Calor experience underscores the need to view the organization as a developmental organism which must evolve, and adapt to, its environment in order to survive. Organizational evolution requires incremental learning at an individual and social level to mature and develop the capacity to accommodate new management systems. Calor Gas went through the phases of evolutionary development in order to adapt to the new environment that the implementation of ABC created. Each stage of development was built on top of the previous one and the rate of development was dependent upon the speed of organizational learning.

Grounded theory is a research approach intended to build theory in order that hypotheses can be formulated for testing. Accordingly, the development of the evolutionary theory to describe the organizational change process invites six hypotheses to provide a basis for future research. The hypotheses are as follows:

Hypothesis 1: An organization institutes new cost management systems when the expected cost of changing is less than the cost of not achieving organizational objectives. The results suggest that organizations are prompted to change their current cost management systems when organizational discomfort reaches a pain threshold.

Hypothesis 2: Organizational learning determines the extent to which an organization adapts to new knowledge systems. The evidence in the case study suggests that learning is the vehicle by which change occurs. Consideration of individual and group learning processes are necessary for the maturation process of the organization, and for understanding and accepting the introduction of technical changes.

Hypothesis 3: The implementation of ABC changes the existing power and reward system, favouring those organizational members who comprehend and employ ABC logic to formulate arguments. The results suggest that those members of the working group that became accustom to using ABC terminology were better positioned for advancing in stature within the group, and influencing the design, construction, and direction of the system.

Hypothesis 4: The degree of support of the ABC project is directly related to the extent to which organizational members are involved with implementation. The research suggests that those organizational members who were involved with the design of the system were inclined to become personally invested with the project. However, this occured only when members perceived the system not as a threat to their position and power.

Hypothesis 5: The ability of the organization to coordinate the change process is increased by a common understanding of the change mechanism language, and is decreased by the fragmented learning of different organizational members. The case study evidence indicates that the change process is stalled until learning objectives are reached and consolidated by all members.

Hypothesis 6: Supporting the ABC project depended more on the faith in its proclaimed benefits than in its internal validity. In the case, it was necessary to gain top management approval before ABC was completely understood. Indeed, even the implementation team was encouraged to support the project prior to training. As members invested time and effort in the project, belief in the change mechanism strengthened, partly because of the increase in understanding it, and partly because their reputations were now closely linked to its success.

There are a number of lessons for managing change which can be derived from each phase of the evolutionary process. In the first stage of evolution, the experience of organizational pain could, in fact, be a good thing. Pain provides a signal to management that some form of change may be necessary. Organizational pain such as poor cash flow and loss of market share, as well as the stress that organizational members experience from operating in this environment, offer clues to management which determine the nature and target of the change requirement. In addition, ABC provides insight to managers on how to separate the causes from the symptoms of pain.

The evolutionary theory of change also emphasises the importance of faith and belief in the selection, introduction, and implementation of a change mechanism. The credibility of the change initiators and top management is therefore vital to the building of support for a change which may be feared and resisted by others in the organization. Recognizing the critical role learning plays in the evolutionary process, and the retarding effect of fragmentation, may encourage management to consider more efficient and effective ways of educating and training personnel during the change process. The potential for fragmented learning to disrupt the change process and even distort the intended purpose of the change is underscored. Therefore, organizations should recognize the importance of reaching the consolidation phase in order to re-evaluate the structure of the change before it is put into practice. Finally, integration of the change mechanism with the organization is vital to the long-term utility of the change. Management must recognize that implementation of the mechanism is a temporary process which must be terminated in order for the change and benefits to be realized. There must be a clear separation between the end of implementation and the beginning of integration. The model which is indefinitely refined retains the "project" or "study" status and will eventually lose the support and interest of management. Managers should be aware of this evolutionary phase of change and plan for its arrival.

This case study also emphasises the role that an organization's response to change plays in influencing the success of the implementation of new management systems. Calor experienced a number of unintended side-effects from the implementation of ABC. Traditional roles of accounting personnel changed and power structures were disrupted, which resulted in resistance and fear among some organizational members (Scapens and Roberts 1993). Learning about the change mechanism was the key factor for accepting change. Argyris and Kaplan (1994) also endorse the notion that resistance to change can be overcome by education and sponsorship.

The ABC system design was influenced by performance and reward configurations. In addition, the accessibility of information helped to build a more cooperative and better informed group of managers. Traditional notions about the security of sensitive financial information diminished as the working group used the new access to information with respect and applied it to productive ends.

SECTION TWO

THE APPLICATION OF GROUNDED THEORY:

Developing an evolutionary theory of change

13.7 INTRODUCTION

Chapter 12 outlined the technical theories developed from studying the implementation of ABC at Calor Gas. It also gave details on how grounded theory techniques of open coding, axial coding, and selective coding were employed in the construction of those theories. The first section of this chapter outlined the organizational theory of evolution developed from studying the implementation process. It exposed an evolutionary process of development which occurred as a response to the introduction of new knowledge systems. The remainder of this chapter is devoted to illustrating how grounded theory research helped to construct the evolutionary theory of development in the change process at Calor Gas.

As discussed in Chapters Eleven and Twelve, grounded theory is a process of classifying data, breaking it down, and putting it back together again in new ways to formulate theory. The theory is grounded by continuously going back to the case data to find evidence which support, or conflicts with the developing themes. It provides a systematic approach to managing and organizing the enormous amount of data associated with case study research. The procedure is described as an orderly process in which the researcher progresses from one stage to the next. However, in practice, the orderly nature of the technique is much less apparent. Often the sequential steps of the techniques merge into one another, making it difficult to determine which step of the technique is actually being applied. The researcher had to continually go back to prior steps in the process to revise portions of the coding data.

This section outlines the grounded theory procedures applied to the implementation of ABC at Calor Gas in order to develop the organizational theory discussed in section one. The first step in the process is to identify core categories upon which all following coding data will be based. Open coding labels are then formulated from the core categories and aggregated to determine the properties and dimensions of each. After breaking down the data using open coding, axial coding is then used to identify the causal conditions, context, strategies, and consequences of each category. Finally, a "story line" is constructed based on axial coding information. A selective coding paradigm model is then used to conceptualize potential themes in the data. This process is discussed below.

13.8 CLARIFYING CORE CATEGORIES

Core categories are derived from the stated aims of the research. They serve to conceptualize the core phenomenon to which all other phenomena relate (Strauss and Corbin 1990). The core categories with respect to organizational phenomena identified in this case study are as follows:

1) The process of change
2) The implementation process of ABC
3) The organizational and behavioural consequences of the implementation process [23]

These core categories are a guide for collecting and naming labels in the open coding process.

13.9 IDENTIFYING OPEN CODING LABELS

The grounded theory technique of open coding is the process of attaching conceptual labels to observed phenomena (Strauss and Corbin 1990). The core categories help direct attention toward phenomena relevant to the research aims. During the many meetings, discussions, interviews and the examination of documentation, conceptual labels were identified for possible use in the construction of theory. Labels were identified in three ways. First, labels were formulated concurrently as the event or happening took place. These labels were normally written down on the margins of a notepad as events unfolded. Second, labels were identified subsequent to the phenomenon by listening to taped records of the event. Tape recorded meetings, interviews, and discussions were replayed for the purpose of transcribing key events and quotes, giving the researcher an opportunity to review the phenomenon more carefully. Third, labels were created by analysing written documentation. This included memos, minutes to meetings, reports and the examination of research notes long after the events have occurred.

Figure 13.3 is a list of open coding labels identified at Calor Gas with respect to organizational phenomena. Next to each label is a "group tag" ('a' through 'e' in figure 13.3) which was applied after collecting all the labels in order to help to aggregate common label names and reduce the number of codes in the open coding portfolio.

PRELIMINARY OPEN CODING LIST

label name	grp	label name	grp
Group conformity	a	Organizational maturation	e
Controller interjections	x	Political networking	d
Defining meeting protocol	e	Job protection strategies	c
Encouragement supplements	d	Educational evolution	b
Making a case	d	Presentation education	d
Change mechanism	e	Learning fragmentation	b
Unified push	e	Power loss	d
Discomfort recognition	e	Knowledge accumulation	b
Incremental change	e	Building change	e
Time process	e	Change resistance	c
Convincing procedure	d	Role adjustment	a
levels of learning	b	Information consolidation	a
Project selling	d	Skill development	b
Expectation control	c	Enforcement tactics	c
Testimony strategy	d	Interest gathering	d
Faith modification	c	Communication signal	x
Credibility enhancement	d	Leadership faith	e
Skill assessment	b	Workload assessment	x
Diagram persuasion	d	Confidence building measures	d
Knowledge reference	b	Information disturbance	e
Monitoring	c	Unification of ideas	a
Motivation screening	d	Personal investment	d
Fear management	c	Hope sustainment	e
Learning gaps	b	Change signals	e
Benefit exploitation	d	Resource commitment	d
Pain experience	c	External change mechanism	e
Suspicion management	c	Internal change mechanism	e
Change agents	e	Project initiators	d
Learning rates	b	Perspective diversity	b
Knowledge growth	b	Skill diversity	b
Message designing	d	Functional background	b
Language formulation	b	Learning development	b
Power containment	e	Language justification	b
Thinking fragmentation	e	Internalized change	e
Support engineering	a	Information accessibility	c
Advancing through learning	b	Belief construction	e
Reward designing	a	Survival response	e
System manipulation	a		
Language power	b		
Concept influence	b		
Mechanism faith	e		
Pain threshold	c		

(figure 13.3) [7, 12]

Coding labels are identified at various points in the research process. Some were identified early in the case study while others were collected at the end of the research. There were no means by which labels could be named and related to each other in a systematic fashion. A label identified in a meeting could be linked to another label identified from a document months later. Each label was given a "group tag" in order to group similar labels under a single category. This reduced the number of label categories and made it easier to assign properties and dimensional ranges to each label. Those codes which could not be grouped were considered irrelevant to the core categories. These labels were coded with an 'x'.

Figure 13.4 shows the aggregated open coding list next to a summarized description of the observed phenomena:

AGGREGATED OPEN CODING LIST

code name	grp	observed phenomenon summary
Role adjustments	a	Increased communication/dialogue between functional managers and accountants. Enhanced awareness of information needs.
Learning development	b	Use of prior research. Solving problems with new cost concepts. Communication using ABC terminology. Learning by doing.
Fear management	c	Use of memos/meetings for information access. Disclosure of top management plans.
Support dialogue	d	Sales-type presentations. Encouragement for support of new ideas Growth in personal investment. Acceptance of new thinking.
Organizational growth	e	Changing perceptions of information, job roles and cost concepts. Matching new ideas with company culture. Adaptability to change.

(figure 13.4) [12, 20]

Each of the aggregate open coding categories represents various observed phenomena from the case. The aggregation process was done by trial and error, and the refinement of coding labels was a continual process of revision and redefinition. Some labels were too broad and needed to be broken down further, while other labels were redefined because they did not match properly the set of observed phenomena assigned to them.

Each coding category is then developed in terms of properties and dimensions. Properties are the attributes or characteristics pertaining to a code label, and dimensions are possible locations of properties along a continuum (Charmaz 1983).

Figure 13.5 shows the open coding categories as well as their properties and dimensional ranges:

CATEGORY LABEL	PROPERTIES	DIMENSIONAL RANGES	
Role adjustment	degree perspective	little adjustment limited perspective	large adjustment full perspective
Learning development	level speed	low understanding incremental	high understanding all at once
Fear management	extent intensity	minor intervention mild resistance	major intervention strong resistance
Support dialogue	amount influence	very little none	very much controlling
Organizational growth	pervasiveness rate	individual slow	organization fast

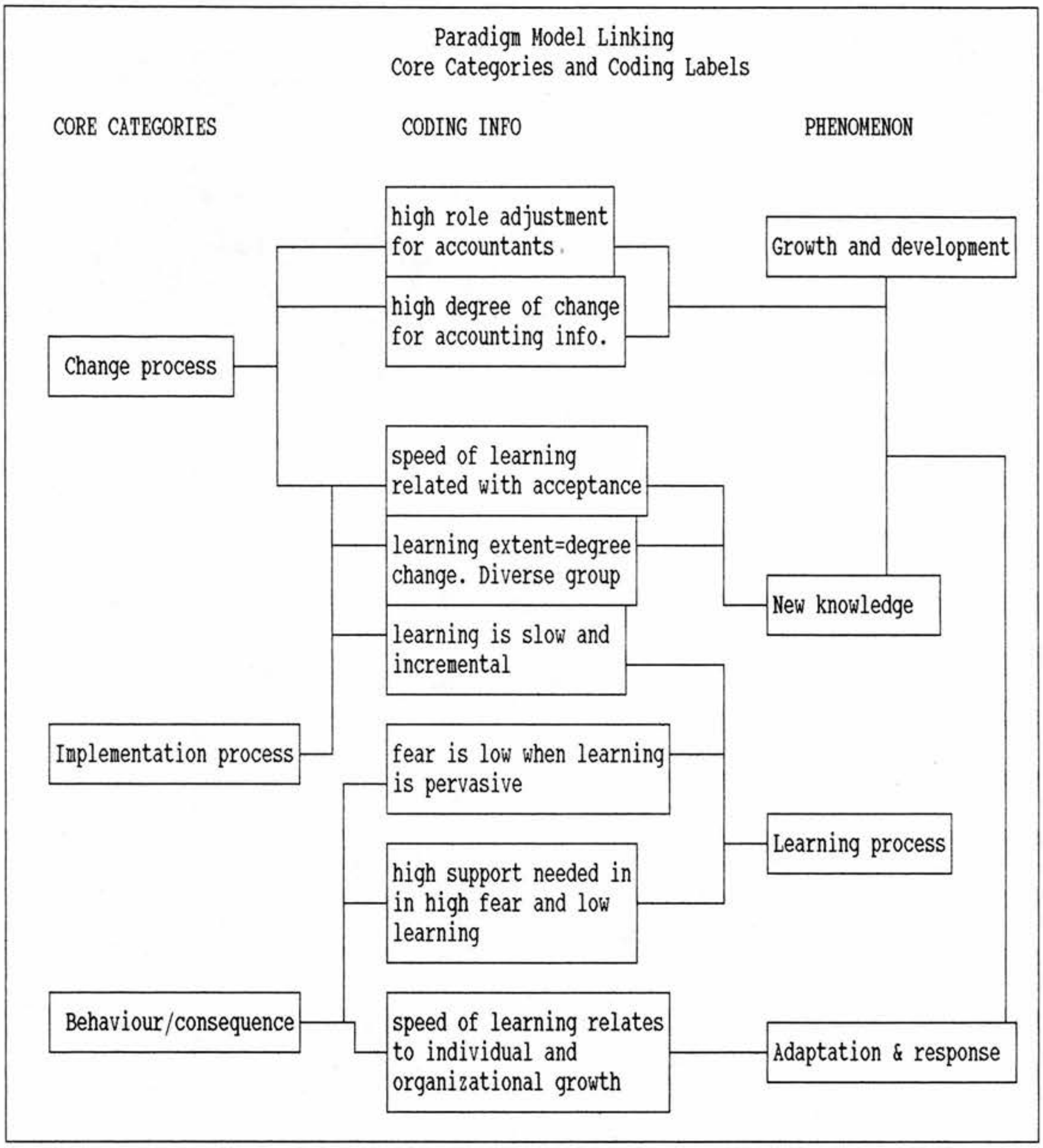
(figure 13.5) [7, 20]

13.10 APPLYING THE AXIAL CODING TECHNIQUE

The open coding process helped to collect important case study data, and to break the data down into a manageable form. Axial coding is used to put the data back together again in new ways in order to start formulating theory. As described in Chapters 11 and 12, axial coding consists of identifying the causal conditions of each category, the context in which it operates, the strategies used to manage it, and the consequences of those strategies (Strauss and Corbin 1990). This is accomplished by asking questions about the category labels, and using the properties and dimensions to think critically about the phenomenon.

13.10.1 Formulating phenomena statements. The core categories provide the basis upon which to develop a description of the organizational phenomena being studied. They direct the researcher's attention and help focus the data collection process on the aims of the research (Schatzman and Strauss 1973). Axial coding is applied to a synergy of core categories, open coding categories, and properties and dimension. Case phenomenon is thus explained by a set of statements which accurately and faithfully depict the observed events or happenings which relate to the aim of the research (Glaser and Strauss 1967a). This is accomplished by asking questions about the core categories, and by using the properties and dimensions of the open coding labels to formulate statements of phenomenon.

A Paradigm Model is used to help link core categories to phenomena. Figure 13.6 shows the development of phenomenon statements by linking core categories with open code label properties and dimensions:



(figure 13.6) [20, 81]

13.10.2 Discovering causal conditions. The phenomenon statements are then developed in terms of the conditions or events which cause them to occur, found by looking back into the case notes and attempting to explain possible reasons for the phenomenon. This was again a process of trial and error. Possible causes are named and then renamed when verifying them with the case study data. For example, looking back at answers to interview questions revealed that poor past performance indicators have resulted in significant cost cutting [76]. Increases in performance targets and decreases in available resources were identified as the cause for changing the organization [82]. However, after further investigation and analysis of case data, it was revealed that poor performance was not the primary cause of change. A more accurate way of identifying the cause of change is the pain experienced from the loss of employees and the stress associated with increased performance expectations from the head office [93]. The pain from increased stress and the loss of personnel as a causal condition was verified by looking back into the data for evidence [102, 115] . This continual process of looking back into the data is known as the grounding process.

13.10.3 Describing the context. Phenomenon context is the specific set of conditions which surround the phenomenon. It is the immediate environment in which the phenomenon exists, and in through which strategies and actions interact (Strauss 1987). For example, the learning process is directed at a very focused goal of implementing ABC, but is accomplished by a very diverse group of learners. Each of the functional managers approaches the learning process with a unique perspective. The diversity of organizational participants slows the learning process down, while the sharp focus of the project facilitates change [41, 120].

13.10.4 Identifying strategies. Strategies refer to the specific decisions, actions and responses that organizational participants carry out to manage the phenomenon [Strauss and Corbin 1990). For example, the group considered how to manage the level of fear and suspicion of group members about the new ABC system. The project initiators gave seminars and presentations to inform the company personnel of how ABC works and what management expects to gain from it [37, 40]. This was proactive strategy to deal with the potential fear that may be associated with the change.

13.10.5 Identifying consequences. Consequences are the specific outcomes which result from strategies employed to manage the phenomena. The consequences may be actual or potential, and may happen in the present or future (Strauss and Corbin 1990). For example, Calor's top management employed a strategy of slowly increasing access to previously restricted financial information to the members of the working group. The consequences of this strategy had the intended effect of improving the quality of the ABC model [47]. However, it also had the unintended effect of creating insecurity among top management [44]. The strategy evolved in order to balance the need for information with the concerns of top management [47].

13.10.6 Bringing data together. The aim of axial coding is to put the data back together in order to help create a foundation upon which to build theory (Parker and Roffey 1993). A paradigm model is used to compare and contrast the conditions, context, strategies, and consequences of organizational phenomena in order to bring the data together. Figure 13.7 presents the paradigm model used to complete the axial coding process.

CAUSAL CONDITION	PHENOMENON	CONTEXT	STRATEGY	CONSEQUENCE
Loss of employees Pain of new performance targets	Organizational growth and development	Highly complex system Large amounts of information	Formalized plan System of use and collection of information	Unintended results Efficient use of resources Maturation process
Computer advances Old ways not working	Introduction of new knowledge	Traditional methods and techniques Complex and diverse products	Use of prior research Adoption of tested change mechanisms	Long and costly implementation process. Questioning of old structures
Adaptation to new thinking Popularization of change mechanism	Learning process in stages of organizational change	Different rates, styles, agendas Process of development	Meetings, seminars presentations. Education models	Change in power and authority Conflict with different learning rates.
Introduction of change mechanism Survival patterns Injection of new information	Organizational adaptation and response	No existing cost system stages of change process Complex systems	Conform to new system. Learn and change existing systems Transformation	Cultural alterations Performance measure conflicts Company transition fatigue

(figure 13.7) [107, 117]

The axial coding paradigm model used is the first step in the grounded theory process which actually moves the data significantly towards theory development. The model helps to conceptualize the data in order to find themes hidden in the categories (Bryman 1989). However, the axial coding paradigm model in figure 13.7 was constructed several times before it took its present form. Several models, which were provisionally constructed, required modification and redefinition of various aspects of the paradigm. Verifying strategies and consequences proved the most demanding aspect of all. Interviews, documents, and reports were reanalysed to verify the elements contained within the paradigm. This is the nature of grounded theory. It is a trial and error process which requires the researcher to go back into the data to redefine, revise, test, and analyze on a continuous basis.

13.11 FORMULATING THE STORY-LINE

A research story is a concise narrative of the central phenomenon under study (Strauss and Corbin 1990). It is used in the selective coding process to unify further the theoretical fragments developed from the axial coding process. The story line is constructed by using the axial coding paradigm model and asking the question, "what is going on here" (Turner 1983). The story line for this case study is as follows:

This research is about the organizational change process which occurred at Calor Gas as it implemented an ABC system. As a result of new pressures and stresses of higher performance targets and declining resources, a change mechanism was introduced to relieve this pressure. The organization adapted and responded to change by learning the new language and techniques of ABC. Organizational growth and development seems to be a pervasive theme in the data. The case data hints at identifiable stages of organizational growth. The diversity of organizational members and the complexity of the new system resulted in a slow incremental change process. New knowledge was built on top of old which transformed the organization from simple to complex. Unintended changes occurred which appeared to be the organization's survival response to a new environment.

The descriptive story line is not sufficient as an organizational theory. It must be converted to a more conceptualized and concise format. The story line is conceptualized by breaking it down into selective coding categories which can be evaluated in terms of their properties and dimensions (Strauss and Corbin 1990). The selective coding categories and their respective properties and dimensions are presented in figure 13.8:

SELECTIVE CODING CATEGORIES WITH PROPERTIES AND DIMENSIONS			
CATEGORY	PROPERTIES	DIMENSIONAL RANGES	
Organizational growth development stages	progressive pace	sequential slow	random fast
Cognitive formulations and faith mechanism potential	role level	limited homogeneous	essential diverse
Transformation from simple to complex	form structure	evolutionary phases	mechanistic unstructured
Response and adaptation	nature stress	immediate comfortable	evolutionary painful

(figure 13.8) [84]

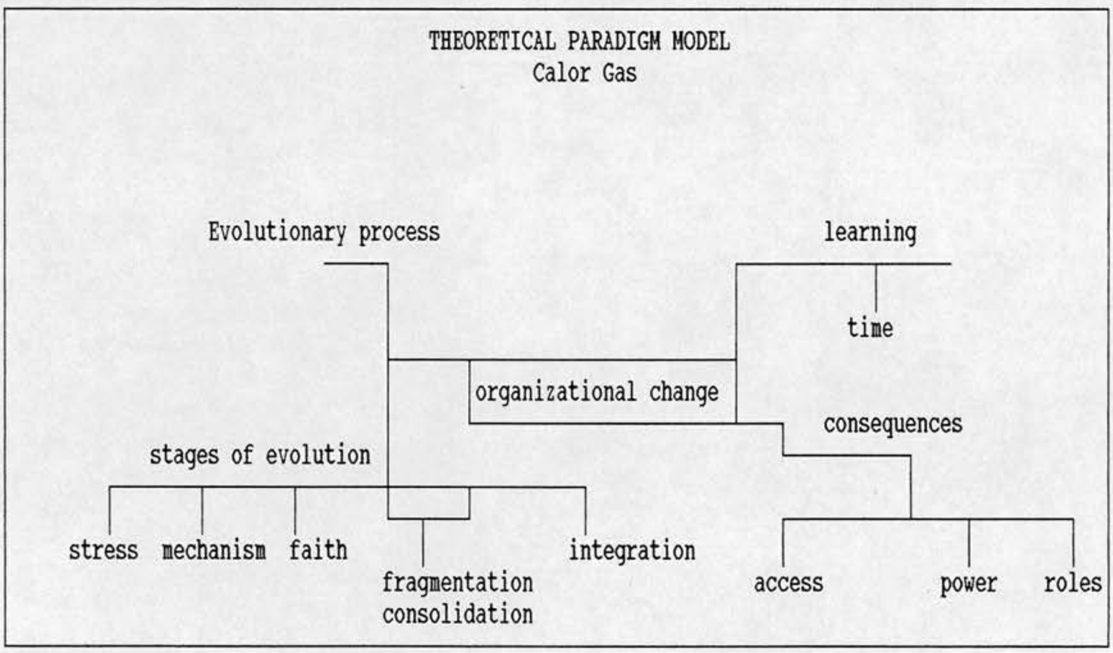
13.12 CONSTRUCTING A SELECTIVE CODING PARADIGM MODEL

The selective coding categories in figure 13.8 point to areas which need to be developed further before an overall theory can be generated. For example, the organizational growth category implies the existence of identifiable stages of change. The classification of these is accomplished by going back to the data to identify stages of organizational change. Other categories provide hints as to the nature of the change. A provisional theory about the change process is revealed through the analysis of the relationships of the selective coding categories. For example, analysing the properties and dimensions of each label further supports the idea that Calor Gas experienced organizational changes which could be characterized by a slow process of learning and transformation in order to adapt to its new environment [77].

The term "evolution" was applied to this process of change because of the small incremental changes which characterized the way learning proceeded. Combining the notion of evolutionary change, that of organizational growth, and the idea that stages of change may exist, provided the insight necessary to formulate a provisional theory that Calor Gas was experiencing identifiable stages of evolutionary development with regard to implementing a new cost management system [75].

This provisional theory is then investigated by looking back into the data to find evidence which supports or conflicts with it and, by looking back at some of the coding labels, help to identify possible stages of the evolutionary process. For example, several of the labels referred to the experience of pain or discomfort which resulted from new performance pressures. This phenomenon hinted at a possible first stage evolutionary process. Interviews and group meeting notes were re-examined and found to support this idea [83, 84]. Events and circumstances in the data showed that the experience of organizational pain was the reason for considering changing the status quo [13, 15]. In addition, quotes from organizational members reveal that the stress and discomfort of the previous situation made change a necessary consideration [24]. Other stages of evolution were identified in a similar manner.

Once the categories are investigated for their significance to the developing theory, a theoretical paradigm model is constructed to relate categories further in a unified form. This is accomplished by diagramming the relationships of categories around the central theme (Strauss and Corbin 1990). Figure 13.9 illustrates the theoretical paradigm model used to construct the organizational theories in this chapter:



(figure 13.9) [102, 107, 117)

13.13 CONCLUSION

The grounded theory techniques of open coding, axial coding, and selective coding provide the research process with the necessary structure upon which to formulate theoretical interpretation. Because of the enormous amount of data and theoretical possibilities, the researcher needs a system to manage, organize and control the data. A system of breaking down data into pieces, exploring the possibilities, and then putting the data back together again provides a unique perspective for the researcher. The organizational theory outlined in the first section of this chapter was developed directly by applying grounded theory procedures, and indirectly by the researcher becoming intimate with the phenomenon under study.

The following and final chapter summarizes the main points of the research results, and offers insight into avenues for future research.

CHAPTER FOURTEEN

CONCLUSION

14.1 INTRODUCTION

ABC has been adopted in many countries for a variety of purposes such as product costing, cost reductions, continuous improvement, quality control, decision-making, and inventory valuation (Innes and Mitchell 1991a, Ask and Ax 1992, Armatage 1993, Drury et al. 1993, Innes and Mitchell 1995). However, in spite of its wide use in industry, there has been little research on the ABC implementation process. This thesis used a case study of Calor Gas for research into the implementation process in order to develop both conceptual models for addressing technical and organizational change, and hypotheses grounded in the data that could be used to guide practical application and future research. The research was guided by previous ABC research literature, and by prolonged exposure to the implementation process using a grounded theory approach (Glaser and Strauss 1967a). Data was collected by observation, active participation, analysis of quantitative data, and through discussions with key organizational personnel.

This final chapter begins with a executive summary of the thesis in which emphasis is given to the role ABC played in the development of internal information, and its significance to the practice of management accounting. This is followed by a summary of the specific contributions of this thesis, and the implications of the research results, contained therein for future research and practical ABC implementations.

14.2 EXECUTIVE SUMMARY

The concepts behind ABC were developed as a result of the dissatisfaction with traditional management accounting techniques. The speed of this development was accelerated by increases in world competition. Johnson and Kaplan (1987a) argue that management accounting techniques for inventory valuation and product costing had become subservient to external financial reporting requirements over the last several decades. Financial accounting regulations strongly influenced the manner in which internal management accounting information was formulated and presented, creating limitations in its applicability to addressing business issues. Although the weaknesses in management accounting information were apparent to managers, importance was attached to the need for symmetry between internal and external reporting. As the western industrialized powers began to feel the strain of competition from developing countries, management began to take a closer look at the way internal information was developed. The quest for increases in efficiency and cost control began to outweigh the desire for internal and external symmetry.

In addition, as the use of machinery and automated production facilities increased, direct labour costs began to decline relative to total costs, making the traditional practice of using direct labour as a basis for allocating overhead less suitable for product costing purposes. Consequently, the distortions in product cost information that resulted from using traditional cost allocation methods became more severe, and were perceived as a main contributor to the reduction in world competitiveness (Johnson and Kaplan 1987a). The use of a single labour-based cost allocation system tended to overstate the cost of simple high-volume products, and understate the cost of complex low-volume products (Turney 1992). This is because the traditional method of allocation did not take into account the relative complexity and diversity of each product.

The idea of using organizational activities as a way of capturing product complexity and diversity was considered many years ago (Staubus 1971). However, it was not until the computer became widely available to business in the late 1980's that putting these ideas into practice became practical. The earlier ideas behind ABC were reintroduced and packaged as "Activity-Based Costing", capturing the interest of both academics and professionals in the business community. Through a series of case studies (Schrader Bellows, John Deere, Hewlett-Packard, Honeywell) and articles (Cooper 1986, 1988a, 1988b, 1989a, 1989b, Kaplan 1986b, 1987, 1988), ABC became one of the most popular management ideas of the 1980's. It has been described as a revolutionary approach to management accounting, rendering many traditional methods obsolete (Kaplan 1984).

However, ABC is far from "revolutionary". Instead it plays an "evolutionary" role in the development of management accounting practices. It is not necessarily an alternative to traditional management accounting practices, but rather an innovative addition that can be integrated into, and used to modify, more established methods and practices. For example, the contribution margin approach can be modified by substituting a multi-level cost variation structure[1] in place of the traditional fixed/variable dichotomy, giving the decision-maker a more accurate picture of the changes in costs and their effect on decisions. In addition, *resource demand* information, provided by ABC systems, could be integrated with *resource supply* information, provided by traditional ledger systems, to give managers a more complete view of costs, and consequently improve the accuracy of predictions of the economic consequences of proposed courses of actions (Salafatinos 1996). ABC concepts

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[1] Cooper (1990a) recognized three cost variation bases other than unit volume that are used in ABC systems. These include batch-level, product-level, and facility-level.

can also be integrated with new management ideas. For example, activity mapping can be used to find bottlenecks when applying the Theory of Constraints (TOC) (Goldratt and Cox 1984) in a manufacturing environment (Salafatinos 1995). This can be accomplished by redefining Goldratt and Cox's (1984) restrictive linear definition of a bottleneck, which states that a constraint exists when the demand of a resource (eg: a machine) exceeds the capacity of that resource. By redefining a bottleneck as a condition where the demand placed on a set of activities exceeds the capacity of those activities, a non-linear relationship between the components of the constraint can be constructed, reflecting a more realistic view of how bottleneck are created. Viewing the TOC approach in ABC terms permits the use of dependency grids and Gantt charts in order to isolate the location of a constraint, and to provide insight into how they might be reduced or eliminated.

The grounded theory research methodology is a relatively novel approach for studying accounting phenomena. Using this approach as a foundation, data was collected and analyzed, and theory was built based on participation in the implementation process at Calor Gas. As prescribed by this approach, this researcher entered the research arena without formulating formal hypotheses. Rather, the data was collected and coded using the grounded theory procedures outlined by Strauss and Corbin (1990), which allowed themes to emerge. Through the application of open coding, axial coding, selective coding, and the formulation of paradigm models, relationships between data categories became apparent. The technical relationships between data categories were investigated further within a problem-solving context consistent with the constructive approach (Kasanen et al. 1993). Organizational relationships within the data were developed to build a theoretical model in order to explain the organizational process of change caused by the implementation of a new cost management system.

This researcher found that using grounded theory coding techniques, participating in the implementation process, and being guided by the problem-solving emphasis of the constructive approach in the case study, revealed specific technical implementation problems that had not been addressed previously in the ABC literature. The research suggested that a balance must be established between the accuracy of the ABC system intended for product costing purposes, and the relevancy of the information intended for continuous improvement purposes. The conflict arises out of the desire to make extensive use of direct costs[2] to attain more accurate product costs, and consequently diluting the usefulness of the activity information. The research also reveals that activities must be identified and formulated in very specific ways in order to construct an ABC model, and for the activity information to be useful to management. Activities should be named in such a way that a reason or purpose of the activity is revealed. This is necessary to establish meaningful activities, and when focused upon, lead to strategic development. Finally, the effective identification of cost objects requires the participation of a wide range of management perspectives. No longer is it adequate to identify basic product categories as the only appropriate cost target. A wide range of perspectives from functional managers is necessary in order to gain an appreciation of the different cost targets, and how they might be used to reduce costs, improve process, and facilitate decision-making.

In the case study, the Marketing Manager was particularly interested in the cost of specific distribution channels and distributor locations. On the other hand, the Production Manager was more concerned with the cost of maintaining filling equipment, and the activities associated with testing of gas cylinders. However, naming, organizing, and logically connecting related cost object categories in an ABC environment is complex. Cost object hierarchies can be used to facilitate an orderly view of the possibilities. A cost object

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[2] The term "direct costs" is used here to represent those costs that bypass the ABC system, and therefore are excluded from activity information. These costs are driven directly to the cost object instead.

hierarchy is essentially a graphical representation of the cost object categories, beginning with the broadest expression of the cost object, branching down to more detailed expressions in a parent-child formation. This approach permits management to evaluate the relationships between categories, and consider which targets are appropriate to classify as cost objects in the ABC system.

The main purpose of the grounded theory methodology is to develop theory. Using the coding techniques, a general theory of organizational change with regard to implementing an ABC system has been developed. The theory of ABC implementation developed at Calor Gas depicted an "evolutionary process" of organizational change. The research suggests that implementing ABC requires the organization to mature through a learning process, and to develop specialized skills and language in order to accommodate the introduction of a new knowledge system. Implementing ABC is much more than a technical alteration, it is also a learning and developmental alteration. Introducing new knowledge systems requires careful planning and coordination. However, many aspects of the implementation at Calor Gas could not be planned for in advance. This is because the project's progression and structure depended greatly upon the organization's response and adaptation to change. The introduction of technical instructions to the organization was not sufficient to orchestrate effective change. Calor also needed time to develop the capacity to comprehend, accept, and adapt to, the change.

14.3 CONTRIBUTIONS TO MANAGEMENT ACCOUNTING LITERATURE

The thesis makes six distinct contributions to the management accounting literature. First, this study provides the first participant observer account of an ABC implementation which spans from the company's search for change to the completion of an ABC system. Second, it provides a rare example of the employment of grounded theory in the study of management accounting. Third, as a result of the theory building emphasis of the research approach, a number of technical-orientated and organizational-type hypotheses have been suggested, providing a basis for future research. Fourth, a number of technical integration issues, which have not been addressed in the existing literature, have been highlighted. Fifth, using the constructive approach (Kasanen et al. 1993) to research, conceptual models have been developed which address significant implementation problems. Finally, as part of theory development, the thesis suggests a framework for understanding the factors that influence organizational change with regard to implementing accounting innovation. Each of these contributions will now be discussed.

14.3.1 Contribution 1: Studying the whole process. Most of the empirical studies about ABC begin some time after the implementation process has commenced, and most commonly after it is completed (Bailey 1991, Bhimani and Pigott 1992a, Cooper and Kaplan 1992a, Carlson and Young 1993, Hobdy et al. 1994, Anderson 1995). This permits only a limited view of the process. This study began as the organization searched and evaluated potential change agents. The case study results are enhanced by the opportunity to experience the entire process from its inception to its conclusion, providing a complete unbroken view of the implementation process.

14.3.2 Contribution 2: Using grounded theory. This research facilitated a unique application of grounded theory in a longitudinal study which monitored an ABC development through the process of change. As the research demonstrates, grounded theory adds a new perspective to the accounting research process. It gives the researcher the necessary flexibility to enter the research domain without subscribing to a set of preconceived theoretical propositions, and without losing the scientific rigour necessary for quality research. Building theory from data should be considered an essential first step in formulating hypotheses and identifying variables for traditional (positivist) style research. In this respect, grounded theory is not an alternative to other established forms of research methods, but rather a vehicle for enhancing the collective investigative process of management accounting research. The potential of the approach is evident from both the technical accounting and organizational issues which its application to the case detected and highlighted.

However, the selection of grounded theory as an accounting research method requires care. Qualitative research of this nature creates some inherent problems with data collection and analysis. It generates large quantities of data in non-standard formats. This limits the researcher's ability to develop linkages between data, which reflect the complex reality under study. Turner (1983) argues that grounded theory addresses this problem by offering a systematic method for managing the enormous amount of data, and by providing a method which links data together in meaningful ways. The approach is however not without its weaknesses. For example, grounded theory procedures do not adequately address the difficulty of dealing with large-scale social phenomena, such as demographic or industrial trends, and other macro-organizational structures. It is best suited for data collection within a single organization where the researcher actively engages with organizational participants and becomes intimate with the process under study (Turner 1983).

As a final prospective note about the research method selected for this thesis, a warning is appropriate. Grounded theory research takes an enormous amount of time, and requires prior experience of the research environment. Firstly, the researcher must spend considerable time becoming intimate with the organization under study. This is necessary to gain theoretical sensitivity with the phenomena (Strauss and Corbin 1990). This researcher spent 15 months of weekly visits, combined with more frequent memos and phone calls, in order to appreciate fully the research subject. Secondly, collecting data and identifying coding labels required many hours of transcribing tape recorded meetings, discussions, and interviews. Field notes had to be painstakingly read and reread to formulate usable coding labels. Coding labels were analyzed and redefined countless times in order to bring some order to the data. Paradigm models were constructed and then torn apart, only to be rebuilt in new ways. There was a continuous process of breaking a phenomenon down and then building it back up to formulate meaningful theory. Therefore, grounded theory research is only recommended for researchers who are familiar with a particular type of organization and who have a lot of time to devote to its study. Fortunately, this researcher had extensive prior experience of working in business organizations, and was also helped by being a full-time researcher which made the necessary time to invest available in the research.

14.3.3 Contribution 3: Hypotheses. In line with the grounded theory approach to research, a set of hypotheses has been developed which are grounded in the case study data. The hypotheses developed here contribute to management accounting research by providing avenues for further research. Some are stated in fully testable terms, while others are expressed more informally as conceptual assertions that require adaptation in a specific context to make them testable.

The hypotheses and conceptual assertions are divided into technical and organizational focuses. They are summarized in figure 14.1 as follows:

TECHNICAL FOCUS

1. There is a negative relationship between the use of direct costs and the utility of activity information.
2. There is a positive relationship between the number of activities and activity distortion from direct costs.
3. Activities are not cross-functional. Activities originate with the individual, thus they must be grouped together to form process information.
4. Effective ABC activities must be linked to the mission of the firm.
5. Activities can be classified as either support or primary. Support activities represent internal services and primary activities directly support the mission of the firm.
6. Cost objects are formulated through negotiation and structured by using hierarchies.

ORGANIZATIONAL FOCUS

1. An organization reaches a pain threshold before it considers a change mechanism.
2. Organizational learning determines the pace of evolution.
3. Organizational members who become proficient at articulating their arguments in ABC terms gain in power and influence.
4. There is a positive relationship between participation in the system design and support for the system.
5. The change process is facilitated by the consolidation of the mechanism language, and burdened by fragmented learning.
6. Faith rather than internal validity provides the basis for ABC support.

(Figure 14.1)

14.3.4 Contribution 4: The integration of ABC. An ABC system must be integrated with existing management and accounting systems and methods. Based on an analysis of the available literature, this thesis demonstrated the applicability of ABC in three areas. First, it demonstrated a innovative technique for linking a resource demand system (ABC) with a resource supply system (traditional ledger) in order to expand the utility of ABC. This was done by formulating a step function equation that incorporated assumptions about specific characteristics of resources and their expected behaviour (Chapter 5). This technique offers management the possibility of using activity information to predict the changes in profit as a result of proposed courses of actions. Second, it suggested a model for improving the traditional contribution margin approach by incorporating four levels of cost variation (Cooper 1990a) beyond the fixed/variable dichotomy (Chapter 7). This approach exhibits the potential to improve the accuracy and relevancy of short-term decision making. Third, this thesis suggested ways of integrating ABC with the innovative management approach of the Theory of Constraints (Chapter 7). This research endorses the use of activity maps, and dependency grids as a means of coordinating activities in order to reduce bottlenecks in the manufacturing process.

14.3.5 Contribution 5: Technical implementation models. Conceptual models have been developed which provide insight into specific implementation problems. First, a model was developed to evaluate the extent to which direct costs should be used. This was done by identifying a number of variables that influence the potential distortion which may result from of the system design (Chapter 12). Another technical contribution to the literature is the naming of six criteria that are necessary for formulating and identifying activities. These criteria are *mission link, cost path, processual, observable*, and *measurable*. A further contribution to the literature is the division of activities into primary and secondary. Primary activities require all six criteria, but secondary activities require only to be processual, observable, and measurable, adopting the mission link and cost path of their affiliated primary activity.

14.3.6 Contribution 6: Organizational process of change. This thesis contributes to the literature an overall theory of the process of change as a result of implementing a new management costing system. It identifies six phases which the organization passes through in order to implement the change process fully (Chapter 13). These phases are *pain, change mechanisms, faith, fragmentation, consolidation,* and *integration*. Innes and Mitchell (1990a) have also developed a theory of the change process, however their theory is based on structural variables that influence change. Their theory does not consider the interpersonal, psychological, and social aspects of the organizational participants. Indeed, Llewellyn (1993) argues that their analysis splits the change process into component parts, and ignores the human agency influence on change. The evolutionary theory of change developed in this thesis emphasizes the maturing process of organizational members, and underscores how learning and faith influence the progression of change.

14.4 IMPLICATIONS OF THE CASE STUDY RESULTS FOR PRACTICE

The technical models for solving implementation problems in Chapter 12 can influence the manner in which companies implement ABC systems. Companies implementing an ABC system need to recognize that the system design is less generic than the ABC literature leads us to believe. Rather, the system design is dependent upon the many and varied needs, interests, and agendas of organizational members, and the potentially conflicting goals of the corporate hierarchy of each firm. Therefore, trade-offs and compromises are a natural and necessary part of trying to design a costing system to satisfy a wide assortment of interests. An alternative option would be to design separate ABC models to serve different objectives. However, this approach may result in conflicting information between models and thus limit the ability of the organization to coordinate its efforts in a unified manner.

The research also suggests that the identification of activities is more complex than implied by the literature on ABC. A two stage process is involved. First, activities should be identified at the individual level and then later linked together to form a cross-functional representation. The implication of this is that organizations should not try to collect the sort of (cross-functional) activities which are promoted in the literature, but rather that they should collect task-oriented (intra-functional) activities from individuals. The implementation team should then design a system which allows tasks to be matched up with other related tasks in an attempt to piece together a faithful representation of *process*. Recognizing that ABC activities are made up of connecting tasks can help management to appreciate how business processes can be modified.

Identifying activities is central to the implementation of ABC systems. When activities are not formulated properly, the value of the system is greatly diminished. Prior research in this area is limited. The criteria presented in Chapter 12 could change the way a company collects and formulates activities, and potentially enhance the effectiveness of the system. Using these criteria forces management to view every aspect of work in relation to the mission of the company. By linking activities to the mission, the costing system becomes uniquely suited to satisfying the goals of the firm.

The research results have also indicated that hierarchies exist in the establishment of cost objects. The implication here is that companies should be more inclined to enlist a broad range of functional perspectives in the formulation of costing targets through a negotiating process. Managers from different departments have varying views about which objects should be targeted for costing. An organization must be open to a range of perspectives in order to formulate a set of cost objects which will advance the aims of the organization. In addition, the results suggest that organizations should use hierarchies as a tool for understanding the complex relationship between potential cost object definitions, and for ensuring that the design of the system meets the objectives of the company as a whole.

The implication of the evolutionary theory of change presented in Chapter 13 is that companies must recognize that adding new technical constructions is not sufficient to change a cost management system. Organizations should include in the implementation plan training and sponsorship programs which begin by building faith in the change mechanism and end by fully integrating the change on a long-term basis. Far too often these developmental considerations are overlooked or undervalued, in implementation plans, and consequently the result is inferior systems. A summary of the implications which are relevant for the practice of management accounting is shown in figure 14.3 on the following page:

SUMMARY OF IMPLICATIONS

DATA COLLECTION AND ANALYSIS

* Activities should be formulated using personal interviews with employees who actually perform the tasks rather than with functional managers.

* Effective ABC activities should be expressed to reveal a purpose, reflecting its relation to the mission of the firm.

* Activities should be classified as either support or primary to the achievement of the company mission.

COMMUNICATION

* The implementation team should be composed of functional managers from a broad cross-section of the company.
* All members of the organization should have some degree of participation in the implementation process.
* Open access to previously guarded financial and other relevant information given to the implementation team facilitates the implementation process and enhances the quality of the system.

DESIGN

* The objectives of the system should be clearly stated in the planning phase.
* Tracing costs directly to the cost objects should be limited when the system's main purpose is to provide ABM information.
* When the aim of the system is to provide accurate product costs, direct costs should be used extensively.
* The implementation plan should consider how to make the transition from project status to long-term "routinization".

ADAPTATION

* Defensive routines should be expected by organizational members if the system is perceived as a primarily cost cutting initiative.
* A resource library containing ABC literature, videos, and workbooks should be made available to members of the implementation team.
* Introducing ABC into an organization leads to some sacrifice of established methods.
* Confidence building measures should be initiated in the early stages of implementation to encourage support and to foster the belief that the mechanism will achieve the desired aims.
* Different learning abilities should be moderated to preserve the interests of the group.
* The accounting department must adopt a wider perspective for internal reporting.
* ABC logic and language tends to be used by organizational members to legitimize and rationalize specific managerial interests.
* Those members most skilled at expressing their view in ABC terms have greater influence.
* Implementing ABC may disrupt reward schemes.
* ABC may alter relationships and disrupt the balance of power and authority.

(Figure 14.2)

14.5 FUTURE AVENUES FOR RESEARCH

There are three avenues for future research that seem most promising for enhancing the understanding of the connection between ABC implementation and technical and organizational change.

First, the case study indicated that there is a significant gap between the existing ABC literature and practical application. Many significant adaptations and deviations from the existing ABC protocol seemed necessary. In some instances, guidance from the literature for addressing practical problems of implementation was conspicuously absent. It is possible that important aspects of the implementation of ABC were overlooked in prior research because the researchers adopted a traditional passive role, studying the implementation process from the vantage of an "outsider looking in". Much can be gained from the active engagement of the researcher with organizational members, and actual performance of implementation tasks. Therefore, it is suggested that future research could be conducted using a participant observation perspective to break down the walls that separate the research subject from the researcher. As a consequence of this, the researcher would gain a more complete understanding of what has occurred.

Second, the study emphasises the constructive approach to research (Kasanen et al. 1993). The technical models constructed in Chapter 12 are intended to aid the implementation of ABC in other companies. Researchers have a role to play in the design and development of accounting innovation, which is an implication that is consistent with Kaplan's (1993) research agenda. Future research might begin with the testing of some of the hypotheses stated in Chapters 12 and 13. Once a hypothesis is tested for its validity, the research process could be pursued further by developing techniques, methods, systems, or models which would help management solve, or at least cope with, the problems identified.

Third, researching accounting and organizational issues using the grounded theory approach is especially appropriate for new topic areas (Eisenhardt 1989). Theory developed from case study research contributes novelty to accounting research, making it less dependent on prior literature or past empirical observation. This approach is particularly useful when a fresh perspective is needed about established ideas, or when investigating new ones.

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Appendix

TABLE OF SOURCES OF EVIDENCE

DOC#	SOURCE DESCRIPTION
001	Company tour: Systems/Management Accountant (Grangemouth Office). February 25 1994.
002	Presentation: ABC Technology Salesperson, Regional Controller & Systems/management Accountant (Grangemouth Office). February 25 1994.
003	Interview: Site Manager Grangemouth (Grangemouth Office). March 1 1994.
004	Interview: Quality/Purchase Manager (Grangemouth Office). March 1 1994.
005	Interview: Stores Manager (Grangemouth Office). March 1 1994.
006	Interview: Appliance Controller (Grangemouth Office). March 1 1994.
007	Code Notes: (Grangemouth Office). March 1 1994.
008	Interview: Systems/Management Accountant (Grangemouth Office). March 7 1994.
009	Discussion: Regional Controller & Systems/Management Accountant. March 7 1994.
010	Interview: Accounting Supervisor. March 10 1994.
011	Presentation: Regional Director, Regional Operations Manager, Regional Controller, Systems/Management Accountant. (Grangemouth Office). March 10 1994.
012	Code notes: (Grangemouth Office). March 10 1994.
013	Meeting: Systems/Management Accountant & Regional Controller (Grangemouth). March 11 1994.
014	Presentation: ABC Power Salesperson, Regional Controller & Systems/Management Accountant. (Grangemouth Office). March 17 1994.
015	Document: Activity Based Costing & Management Implementation Plan Outline. March 21 1994.
016	Document: Working Outline for ABC Implementation. Supplied by researcher (University of Edinburgh). March 18 1994.
017	Meeting: Working Group. (Grangemouth Office). April 21 1994.
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021 Discussion: Systems/Management Accountant & Regional Controller (Grangemouth Office). March 21 1994.

022 Meeting: Working Group (Grangemouth Office). June 1 1994.

023 Meeting: Systems/Management Accountant & Armstrong Laing Representative (Grangemouth Office). June 30 1994.

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025 Memo:From Researcher to Regional Controller (University of Edinburgh). July 8 1994.

026 Meeting: University Accounting Student & Systems/Management Accountant (Grangemouth Office). July 13 1994.

027 Memo: From Researcher to Systems/Management Accountant (University of Edinburgh). July 18 1994.

028 Meeting: Working Group (Grangemouth Office). July 20 1994.

029 Meeting: Working Group (Grangemouth Office). August 17 1994.

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031 Interview: Regional Controller (Grangemouth Office). August 17 1994.

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061 Document: Product Hierarchy diagram (Grangemouth Office). July 19 1994.

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136 Telephone conversation: Systems/Management Accountant. March 17 1994.

137 Telephone conversation: Systems/Management Accountant. July 8 1994.

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139 Telephone conversation: Regional Controller. July 5 1994.

140 Telephone conversation: Regional Controller. July 22 1994.

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